Thermal Desorption Tubes, Accessories & Spares




2017/2018

MARKES international

World-leading products for thermal desorption

Markes International has for 20 years been at the forefront of innovation for enhancing the measurement of trace-level VOCs and SVOCs by TD–GC. Our suite of instruments for thermal desorption sets the benchmark for quality and reliability:

- **TD100-xr**
  High-throughput 100-tube automated thermal desorber.
- **UNITY-xr**
  Single-tube thermal desorber featuring sample re-collection of all split flows.
- **Air Server-xr**
  Versatile on-line VOC monitoring system.
- **ULTRA-xr**
  High-throughput 100-tube autosampler for UNITY-xr.
- **CIA *Advantage***
  Cryogen-free automated canister autosampler and pre-concentrator.
- **TT24-7**
  Twin-trap instrument for near-real-time on-line monitoring.
- **Kori-xr**
  An innovative approach to on-line monitoring of polar species in humid air.

Find out more at www.markes.com

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Ordering information

Ordering from Markes couldn't be simpler, whether by phone, fax, email or online. Payment is accepted by credit card (Mastercard or Visa) on account. If you need help with your order, simply contact one of our highly experienced chemists or customer service agents at any of Markes' main sales locations:

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You can also place orders with any of our global distributors:

www.markes.com/Global-Distributors.aspx

Quality-assured tubes, accessories and spares from the TD experts

When it comes to tubes, accessories and spares for thermal desorption, we offer our customers nothing but the best:

- Application expertise that is second-to-none.
- Fast delivery and excellent customer service.
- The widest range of sorbent sampling tubes – whatever your TD application, we have the optimum solution.
- World-leading, patented technologies for thermal desorption.
- Stringent quality control of our manufacturing procedures.
- ISO 9001 accreditation.
- Worldwide distributor and user base.
- Custom service – if you want something special, we can do it.

And most importantly... a 100% quality guarantee.

If you're not satisfied with the products we supply, we will provide replacements or give you your money back, whichever you prefer.

Contact Markes today for fast and friendly advice on any aspect of thermal desorption.

Sorbent tubes and cold traps

Umatched product range, with expert advice from the world's leading TD supplier

Product highlights

- Unrivalled range of tube types and sorbent options
- Quality assured – each tube individually checked
- Sophisticated tube labels as standard
- Fast delivery and competitive prices
- Quality-assured cold traps

Contact Markes International for expert advice

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www.markes.com

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Quality-assured sorbent tubes

Backed up by fast and friendly service, Markes' tubes provide optimum sampling and analytical performance. Our range includes everything from cost-effective packages of industry-standard tubes to the last word in sorbent tube innovation.

- Choose from tubes manufactured from stainless steel, inert-coated stainless steel or glass.
- We stringently quality-check our tubes, and they're all packed to a tolerance of ±2.5% or better.
- Choose the 'conditioned and capped' option if you'd like your tubes to be ready to use on arrival.
- Need a customised tube for your application? Contact us to discuss alternative sorbent packing mixes, bed lengths or mesh sizes… as well as tube unpacking, repacking or re-conditioning.

Always happy to discuss your requirements

As the world's leading manufacturer of thermal desorption equipment, Markes International understands the demands of difficult applications, and is uniquely well-placed to provide any extra help you may need – just contact us with any questions.

Clean tubes are essential for successful sampling. Make sure your tubes are contaminant-free by using Markes' TC-20 and TC-20 TAG tube conditioners – see page 14.

What can you use our tubes for?

The tubes listed on pages 8–11 have a wide variety of uses… but as well as the tubes, make sure you've got all the accessories you need for successful sampling.

Diffusive (passive) sampling uses single-bed sorbent tubes, and is a convenient, quantitative and inexpensive option for fenceline monitoring and assessing personal exposure.

See page 22 for accessories for diffusive sampling.

Pumped sampling onto sorbent tubes is a versatile option for simultaneous monitoring of multiple target compounds, especially in unknown atmospheres. All Markes' tubes are compatible with pumped sampling.

See page 24 for Markes' ACTI-VOC and Easy-VOC pumps.

Headspace sampling onto sorbent tubes is a powerful technique for releasing volatiles from consumer goods, construction materials, foods, biological specimens and many more samples.

See page 38 for details of Markes' Micro-Chamber/Thermal Extractor, and page 24 for Markes' ACTI-VOC pump.

Sorptive extraction involves the release of volatiles from PDMS sorbent contained in an empty TD tube. It has a wide variety of applications, especially for the aroma profiling of foods, beverages and fragranced goods.

See page 40 for details of Markes' HiSorb probe system.

Direct desorption uses empty TD tubes to release volatiles from small samples.

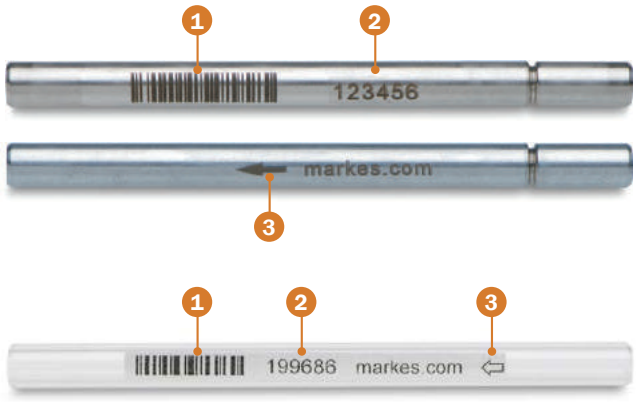
See page 20 for more information.

Sorbent tube labelling

Standard features

All Markes International's tubes are permanently labelled with a **unique ID number, in clear barcode** 1 **and numerical formats** 2, to help you keep track of samples and tube stock. The barcodes reduce errors and minimise time-consuming manual data entry. See below for Markes' recommended barcode reader.

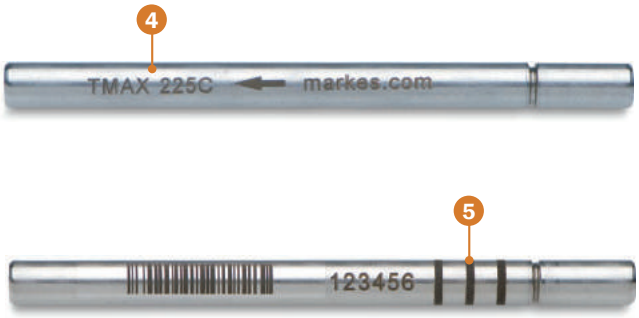
Each tube also features a **sampling arrow** 3 indicating the direction of the air/gas sampling flow to aid field monitoring.



Special labelling options

You can specify up to 10 additional **alphanumeric characters** 4 to be etched on Markes International's stainless steel tubes – for example, to identify the sorbent, maximum temperature or company name. Just include clear details of your requirements with your order.

Stainless steel tubes can also be etched with up to five **permanent black bands** 5, for rapid visual identification of sorbent type or project ID. Just send us your banding requirements with your order, or contact us with any questions.



Barcode reader for sorbent tubes

Markes International supplies a barcode reader for accurate and reliable reading of barcodes on Markes' metal and glass sorbent tubes.

Description	Part number
Corded barcode reader *For at-PC use; available USB port required. Not available in the USA.*	C-BCR

For ultimate control of information relating to tubes and samples, use Markes' TubeTAG system. See page 15 for details.

For more information on any of Markes International's sorbent tube labelling options, just contact a technical specialist for expert advice.

Stainless steel tubes

All Markes' industry- standard thermal desorption tubes are 3½″ (89 mm) long, with ¼″ (6.4 mm) o.d. and 5 mm i.d. They are manufactured to precise tolerances under ISO 9001, and we guarantee their compatibility with any TD system that supports industry-standard tubes.

Markes International's industry-standard stainless steel tubes are made from the highest-specification materials, and are suitable for the majority of VOC air monitoring applications across a wide range of compound types and atmospheric concentrations. They comply with official standard methods such as US EPA Method TO-17 and EN ISO 16017.

Markes International's most popular stainless steel tubes

Description (all packs of 10)	Analyte range	Part number	
		Unconditioned, without caps	Conditioned and capped
Tenax TA	C_6–C_{30}	C1-AXXX-5003	C1-AAXX-5003
Carbograph 1TD	C_6–C_{14}	C1-AXXX-5009	C1-AAXX-5009
'Graphitised carbon'	C_6–C_{20}	C2-AXXX-5126	C2-AAXX-5126
'Universal'	$C_{2/3}$–C_{30}	C3-AXXX-5266	C3-AAXX-5266
'Air toxics'	$C_{2/3}$–C_{14}	C2-AXXX-5270	C2-AAXX-5270
'Graphitised carbon universal'	C_3–C_{20}	C2-AXXX-5264	C2-AAXX-5264
'PAH'	C_6–C_{40}	C2-AXXX-5138	C2-AAXX-5138
'SVOC'	C_6–C_{40}	C2-AXXX-5342	C2-AAXX-5343
'Hydrophobic'	C_6–C_{30}	C2-AXXX-5032	C2-AAXX-5032
'Bio-monitoring'	C_4–C_{30}	C2-AXXX-5149	C2-AAXX-5149
'Material emissions/ Soil gas'	C_4–C_{40}	C3-AXXX-5304	C3-AAXX-5304
Empty	—	C0-AXXX-0000	—

Tubes perfect for your application...

PAHs in air:

Using large sample volumes and an optimised analytical protocol, this sorbent tube can be used to monitor polycyclic aromatic hydrocarbons at ppt levels.

Material emissions/Indoor air:

These tubes comply with ISO 16000-6 for simultaneous monitoring of VVOCs, VOCs and SVOCs. They are particularly suitable for monitoring indoor air quality and for testing chemicals released by products and materials.

Soil gas/Vapour intrusion:

These tubes, packed with the best sorbents for monitoring underground contamination and vapour intrusion, are compatible with everything from C_4 hydrocarbons to middle-distillate fuels, as well as high-humidity air.

Sorptive extraction and direct desorption:

Empty tubes are ideal for releasing volatiles from HiSorb sorptive extraction probes (see page 40), as well as for direct desorption of small samples of relatively homogeneous materials (see page 20).

Inert-coated stainless steel tubes

Inert-coated stainless steel tubes are treated inside and out with industry-leading SilcoNert™ coating. This eliminates surface adsorption of active compounds and avoids the breakdown of thermally labile analytes during analysis.

Markes International's inert-coated stainless steel tubes are a robust alternative to glass tubes for sampling thermally labile and reactive compounds, due to the extremely thin inert coating on all surfaces.

Markes International's most popular inert-coated stainless steel tubes

Description (all packs of 10)	Analyte range	Part number	
		Unconditioned, without caps	Conditioned and capped
Tenax TA	C_6–C_{30}	C1-CXXX-5003	C1-CAXX-5003
'EPA 325'	C_3–C_7	C1-CXXX-5020	C1-CAXX-5020
'PAH'	C_6–C_{40}	C2-CXXX-5138	C2-CAXX-5138
'Odour/Sulfur'	C_3–C_{30}	C2-CXXX-5314	C2-CAXX-5314
'Bio-monitoring'	C_4–C_{30}	C2-CXXX-5149	C2-CAXX-5149
'Material emissions/ Soil gas'	C_4–C_{40}	C3-CXXX-5304	C3-CAXX-5304
Empty	—	C0-CXXX-0000	—

Tubes perfect for your application...

US EPA Method 325:

Markes offers both tubes referenced for monitoring fugitive emissions at refinery fencelines (specifically, BTEX and butadiene), and is happy to advise on which option would work best for you.

Monitoring odours:

These tubes are packed with a carefully optimised combination of weak and strong inert sorbents, making them perfect for profiling a wide range of compounds including reactive sulfur species.

To order your tubes or ask a question about which tube is best for your application, simply telephone or send an email.

Glass tubes

Markes' glass tubes have a restriction rather than a fused glass frit, leading to better recovery of reactive and higher-boiling species.

Markes International's high-quality glass tubes are completely inert, making them ideal for sampling reactive species. The clarity of the glass makes it easy to check the status of the sorbent, while also making them perfect for direct desorption of small samples.

Markes International's most popular glass tubes

Description (all packs of 10)	Analyte range	Part number	
		Unconditioned, without caps	Conditioned and capped
Tenax TA	C_6–C_{30}	C1-BXXX-5039	C1-BAXX-5039
'Air toxics'	$C_{2/3}$–C_{14}	C2-BXXX-5259	C2-BAXX-5259
'Odour/Sulfur'	C_3–C_{30} & thiols	C2-BXXX-5315	C2-BAXX-5315
'Hydrophobic'	C_6–C_{30}	C2-BXXX-5068	C2-BAXX-5068
'Graphitised carbon'	C_6–C_{20}	C2-BXXX-5197	C2-BAXX-5197
'SVOC'	C_6–C_{40}	C2-BXXX-5343	C2-BAXX-5343
'Bio-monitoring'	C_4–C_{30}	C2-BXXX-5201	C2-BAXX-5201
'Universal'	$C_{2/3}$–C_{30}	C3-BXXX-5267	C3-BAXX-5267
'Material emissions/ Soil gas'	C_4–C_{40}	C3-BXXX-5310	C3-BAXX-5310
Empty, restricted	—	C0-BXXX-0000	—
Empty, restricted *Suitable for direct desorption*	—	C0-NXXX-0000	—
Empty, unrestricted	—	C0-FXXX-0000	—

Tubes perfect for your application...

US EPA Method TO-17:

Packed with medium and strong sorbents, these tubes trap polar and non-polar 'air toxics' ranging from propene to hexachlorobutadiene, with minimal water retention.

Direct desorption:

These tubes guarantee correct positioning of samples for direct desorption, as well as allowing easy inspection before and after analysis.

Don't forget to order long-term storage caps for your tubes – see page 17.

SafeLok™ tubes

Markes International's SafeLok tubes provide unrivalled protection for trace and toxic samples, while complying fully with standard methods for pumped sampling.

With a diffusion-locking insert at each end, SafeLok tubes ensure sample integrity throughout storage, transport and analysis. They are available in both regular and inert-coated stainless steel, and contain the same amount of sorbent as their non-SafeLok equivalents.

Markes' patented SafeLok tubes incorporate a diffusion-locking insert at each end, preventing sample loss or contamination.

Markes International's most popular SafeLok tubes

Description (all packs of 10)	Analyte range	Part number	
		Unconditioned, without caps	Conditioned and capped
Stainless steel			
Tenax TA	C_6–C_{30}	C1-DXXX-5003	C1-DAXX-5003
'Universal'	$C_{2/3}$–C_{30}	C1-DXXX-5266	C1-DAXX-5266
Inert-coated stainless steel			
Tenax TA	C_6–C_{30}	C1-EXXX-5003	C1-EAXX-5003
'Universal'	$C_{2/3}$–C_{30}	C3-EXXX-5266	C3-EAXX-5266

Tubes perfect for your application...

Monitoring unknown atmospheres:

An optimised combination of weak, medium and strong sorbents allows near-universal screening of VOCs and SVOCs in uncharacterised indoor and outdoor environments, with minimal water retention. SafeLok technology makes these tubes uniquely resistant to chemical losses or contamination.

4½″ DAAMS tubes

DAAMS tubes, with dimensions of 4½″ (114 mm) × 6 mm o.d., are packed by Markes International's experts to ensure optimum recovery of challenging and toxic analytes such as chemical agents, making them ideal for chemical defence and counter-terrorism applications.

Description (all in packs of 10)	Part number
Glass (unconditioned, without caps)	
Empty	C0-LXXX-0000
Tenax TA *Suitable for most of the 'G' agents, HD, VX and 'Russian VX', amongst others*	C1-LXXX-7001
HayeSep D *Suitable for the 'G' analogue of VX*	C1-LXXX-7003
Stainless steel (unconditioned, without caps)	
Tenax TA *Suitable for most of the 'G' agents, HD, VX and 'Russian VX', amongst others*	C1-VXXX-7010

Cold traps (focusing traps)

Recommended cold traps for UNITY 2, UNITY-xr, TD-100 and TD100-xr instruments [1]

Description	Part number
Cold trap, 'High-boilers', C_6 to C_{40}	U-T1HBL-2S
Cold trap, 'General-purpose hydrophobic', $C_{4/5}$ to $C_{30/32}$	U-T2GPH-2S
Cold trap, 'TO-14 Air toxics', C_2 to C_{14}	U-T3ATX-2S
Cold trap, 'Water management', C_2 to C_{20}	U-T4WMT-2S
Cold trap, 'Ozone precursors and freons'	U-T5O3F-2S
Cold trap, 'Sulfur/labile'	U-T6SUL-2S
Cold trap, empty	U-T7EMP-2S
Cold trap, custom-packed [2]	U-T8CUS-2S
Cold trap, Tenax TA	U-T9TNT
Cold trap, 'Chemical warfare agents'	U-T10CW-2S
Cold trap, 'General-purpose carbon', $C_{4/5}$ to $C_{30/32}$	U-T11GPC-2S
Cold trap, 'Material emissions', C_4 to C_{32}	U-T12ME-2S
Cold trap, 'Hydrogen sulfide'	U-T14H2S-2S
Cold trap, 'TO-15/TO-17 Air toxics', $C_{2/3}$ to $C_{30/32}$	U-T15ATA-2S
Cold trap, 'Greenhouse gases', C_2 to C_{14}	U-T16GHG-2S
Cold trap, 'Ozone precursors'	U-T17O3P-2S
Cold trap, '325'	U-T18325-2S
Cold trap, 'PAH'	U-T19PAH-2S
Cold trap, 'PAMS'	U-T20PAMS-2S

Recommended cold trap for Kori-xr™

Description	Part number
Cold trap, empty, for Kori-xr	U-T1KORI

Recommended cold traps for TT24-7 Series 1 and Series 2 [3]

Description	Part number
Cold trap, TT24-7, 'CWA' *Suitable for VX in particular*	T-1VX
Cold trap, TT24-7, 'CWA' *Suitable for HD in particular*	T-2HD
Cold trap, TT24-7, 'CWA' *Suitable for the GB/GE analogue of VX in particular*	T-3GBGE
Cold trap, TT24-7, 'Air toxics'	T-4ATX
Cold trap, TT24-7, empty	T-6EMP
Cold trap, TT24-7, custom-packed [2]	T-7CUS
Cold trap, TT24-7, 'Material emissions'	T-8MAT
Cold trap, TT24-7, 'General-purpose carbon'	T-9GPC
Cold trap, TT24-7, 'Ozone precursors'	T-11OP
Cold trap, TT24-7, 'Air monitoring'	T-12AM

To purchase any of Markes International's cold traps, or enquire about availability of previously listed traps, simply contact Markes' technical specialists.

1. UNITY 1 instruments require different cold traps from those listed above, and because this instrument was discontinued in 2008, we can now no longer guarantee that they will be available. If you need cold traps for a UNITY 1, please contact Markes International for advice.
2. Please call Markes to discuss your requirements for custom-packed cold traps before ordering.
3. Note that two traps are required for each TT24-7 system.

Tube accessories

Everyday tools for enhanced tube sampling

Product highlights

- Specialist accessories designed to enhance data confidence and make your job easier
- Time-saving TC-20™ and TC-20 TAG™ tube conditioners
- Innovative TubeTAG™ system for ultimate tube traceability
- The only storage caps independently validated to maintain sample integrity for over 2 years
- Patented analytical caps to ensure sample integrity and stability on Markes' TD autosamplers
- Tubes and liners for direct desorption

Contact Markes International for expert advice

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Germany: +49 (0)6102 8825569

TC-20™ & TC-20 TAG™ conditioning/dry-purging

Markes International's TC-20 and TC-20 TAG save time and money by freeing up your TD–GC–MS system to run samples rather than condition tubes.

With temperatures up to 400°C and capacity for up to 20 industry-standard sorbent tubes, both instruments pass a uniform flow of inexpensive nitrogen (or helium carrier gas) through each attached tube at a constant rate – guaranteeing clean tubes whatever the sorbent packing.

TC-20

The TC-20 is a general-purpose tube conditioner (and dry-purge unit) for enhancing laboratory productivity across a range of projects.

Description	Part number
TC-20 multi-tube conditioner (115 V)	R-TC20-1
TC-20 multi-tube conditioner (230 V)	R-TC20-2
Filter for TC-20, carbon, 120 mm × 120 mm, pk 4 *(replacement filters for cooling fan at rear of TC-20 or TC-20 TAG)*	R-FLTR4

TC-20 TAG

The TC-20 TAG allows industry-standard single-bed tubes fitted with Markes' RFID TubeTAGs (see page 15) to be conditioned (or dry-purged), and is perfect for dedicated use as part of a TubeTAG-enabled monitoring campaign – for example, refinery fenceline monitoring in accordance with US EPA Method 325.

Description	Part number
TC-20 TAG multi-tube conditioner (115 V)	R-TC20-TAG-115
TC-20 TAG multi-tube conditioner (230 V)	R-TC20-TAG-230
TC-20 TAG spare manifold, pk 2	R-TCTAG-KIT
Filter for TC-20, carbon, 120 mm × 120 mm, pk 4 *(replacement filters for cooling fan at rear of TC-20 or TC-20 TAG)*	R-FLTR4

For more information on the TC-20 and TC-20 TAG, download the brochure.

TubeTAG™ – Sorbent tube information handling

Offering total peace-of-mind, Markes International's patented TubeTAG technology allows you to track tube history throughout the lifetime of a tube, and log sample information.

Using robust radio-frequency identification (RFID) tags that clip securely onto stainless steel or glass tubes, TubeTAG eliminates transcription errors, optimising control of the chain of custody throughout field monitoring and laboratory analysis. It is recommended by key standard methods such as US EPA Method 325.

TubeTAG is compatible with Markes' entire range of TD systems, and TubeTAGs are easily fitted to your existing tube stock.

For more information on TubeTAG, refer to the separate brochure and Application Note 082.

For details of Markes International's cost-effective TubeTAG starter kit, see page 49.

TAG*SCRIBE* ™

Markes International's portable Windows®-based laptop- or tablet-controlled TAG*SCRIBE* is a convenient alternative to using a tag-ready TD autosampler to enter information onto tags, whether in the field or laboratory.

The versatile TubeTAG software interface allows you to enter a wide range of tube and sample information, including the sorbent details, project name, monitoring location, and sampling parameters.

Description	Part number
TAG*SCRIBE* read/write device for all TubeTAGs	C-SCRIBE

Just let us know if you'd like to order sorbent tubes with TubeTAG RFID tags already attached.

TubeTAG accessories

Packs of tags for fitting to sorbent tubes

For attaching to existing sorbent tubes, whether stainless steel or glass.

Description	Part number
TubeTAG for stainless steel tubes, pk 10	C-TAG10
TubeTAG for stainless steel tubes, pk 100	C-TAG100
TubeTAG for glass tubes, pk 10	C-TAGG10
TubeTAG for glass tubes, pk 100	C-TAGG100

Tools for TubeTAG

Special tools for fixing and removing tags, and for fitting TubeTAG-compatible storage caps.

Description	Part number
TubeTAG fixing/removal tool for stainless steel tubes	C-TAGTL
TubeTAG fixing/removal tool for glass tubes	C-TAGKY
TAGLok™ tool for tightening/removing standard and TAG-ready ¼″ storage caps	C-TAGLOK

TubeTAG-compatible storage caps

These long-term storage caps ensure that tagged tubes are securely sealed.

Description	Part number
Tag-ready ¼″ brass long-term storage caps for industry-standard stainless steel tubes	
Cap, brass, ¼″ & PTFE ferrule, tag-ready, pk 10, for ¼″ metal tubes	C-TCF10
Cap, brass, ¼″ & PTFE ferrule, tag-ready, pk 100, for ¼″ metal tubes	C-TCF100
Tag-ready ¼″ or 6 mm brass long-term storage caps for glass tube	
Cap, brass, ¼″ & blind PTFE ferrule, tag-ready, pk 10, for ¼″ glass tubes	C-T4GCF10
Cap, brass, ¼″ & blind PTFE ferrule, tag-ready, pk 100, for ¼″ glass tubes	C-T4GCF100
Cap, brass, 6 mm & blind PTFE ferrule, tag-ready, pk 10, for 6 mm glass tubes	C-T6GCF10
Cap, brass, 6 mm & blind PTFE ferrule, tag-ready, pk 100, for 6 mm glass tubes	C-T6GCF100
Pairs of long-term storage caps for ¼″ tagged tubes	
Cap, brass, ¼″ & PTFE ferrule (one standard, one tag-ready), pk 10 pairs, for ¼″ metal tubes	C-TCFP10
Cap, brass, ¼″ & PTFE ferrule (one standard, one tag-ready), pk 100 pairs, for ¼″ metal tubes	C-TCFP100

Talk to Markes International to discuss any aspect of implementing TubeTAG technology in your laboratory.

Email: enquiries@markes.com **Web:** www.markes.com

Caps

Long-term storage caps

Markes International's precision-engineered long-term storage caps meet stringent cleanliness specifications and tight manufacturing tolerances.
They are recommended by international standard methods and are independently validated for long-term sample storage (up to 27 months).

They are available in brass or aluminium, and should be used with a combined PTFE ferrule (¼″ or 6 mm i.d. as required).

Description	Part number
Standard ¼″ brass and aluminium long-term storage caps for industry-standard tubes (stainless steel or glass)	
Cap, storage, brass, ¼″ & PTFE ferrule, pk 10	C-CF010
Cap, storage, brass, ¼″ & PTFE ferrule, pk 20	C-CF020
Cap, storage, brass, ¼″ & PTFE ferrule, pk 100	C-CF100
Cap, storage, brass, ¼″ & PTFE ferrule, pk 200	C-CF200
Cap, storage, aluminium, ¼″ & PTFE ferrule, pk 20	C-CFA20
Cap, storage, aluminium, ¼″ & PTFE ferrule, pk 200	C-CFA200
Ferrule, ¼″, combined PTFE, pk 20	C-FP020
Ferrule, ¼″, combined PTFE, pk 200	C-FP200
6 mm brass long-term storage caps for 6 mm stainless steel tubes or glass tubes with 6 mm o.d. ends	
Cap, storage, brass, 6 mm & PTFE ferrule, pk 10	C-CF010-XZ
Cap, storage, brass, 6 mm & PTFE ferrule, pk 20	C-CF020-XZ
Cap, storage, brass, 6 mm & PTFE ferrule, pk 100	C-CF100-XZ
Cap, storage, brass, 6 mm & PTFE ferrule, pk 200	C-CF200-XZ
Ferrule, 6 mm, combined PTFE, pk 20	C-FP020-XZ
Ferrule, 6 mm, combined PTFE, pk 200	C-FP200-XZ

For advice on tube capping and storage, see Application Note 019.

See page 16 for storage caps compatible with TubeTAG.

DiffLok™ caps

The patented diffusion-locking technology used in DiffLok caps preserves sample integrity by preventing both analyte loss and artefact ingress, while still allowing analytes to be released into the TD instrument when pressure is applied.

Unique to Markes, DiffLok caps simply push on to the ends of tubes and ensure reproducible results during analysis on the ULTRA-xr and TD100-xr autosamplers.

DiffLok caps are available for ¼″ and 6 mm o.d. tubes and are available in stainless and inert-coated steel.

Description	Part number
Cap, DiffLok, stainless steel, ¼″, pk 10	C-DL010
Cap, DiffLok, stainless steel, ¼″, pk 100	C-DL100
Cap, DiffLok, inert, ¼″, pk 10	C-DLS10
Cap, DiffLok, inert, ¼″, pk 100	C-DL1S0
Cap, DiffLok (one stainless steel, one inert), ¼″, pk 10 pairs	C-DLP10
Cap, DiffLok (one stainless steel, one inert), ¼″, pk 100 pairs	C-DL1P0
Cap, DiffLok (one stainless steel, one inert), 6 mm, pk 10 pairs	C-DLP10-XZ
Cap, DiffLok (one stainless steel, one inert), 6 mm, pk 100 pairs	C-DL1P0-XZ
O-Ring, low-emission, pk 10 (replacements for ¼″ DiffLok caps)	U-COV10
O-Ring, low-emission, pk 10 (replacements for ¼″ DiffLok caps)	U-COV100
O-Ring, low-emission, pk 10 (replacements for 6 mm DiffLok caps)	U-COV45
O-Ring, low-emission, pk 100 (replacements for 6 mm DiffLok caps)	U-COV450

Short-term storage caps

Aluminium push-on caps with O-ring seals are convenient for short-term storage of cleaned or sampled ¼″ tubes.

Description	Part number
Cap, push-on, aluminium, ¼″, pk 20	C-AC020
Cap, push-on, aluminium, ¼″, pk 200	C-AC200

Gauzes and springs

Sorbent-retaining gauzes

Markes International's sorbent-retaining gauzes are manufactured from high-quality regular or inert-coated stainless steel for accurate sorbent positioning and robust separation of multiple sorbents above 80 mesh particle size.

Description	Part number
Sorbent-retaining gauze, pk 20	C-GZ020
Sorbent-retaining gauze, pk 200	C-GZ200
Sorbent-retaining gauze, pk 2000	C-GZ2000
Sorbent-retaining gauze, inert, pk 10	C-GZI10
Sorbent-retaining gauze, inert, pk 100	C-GZI100

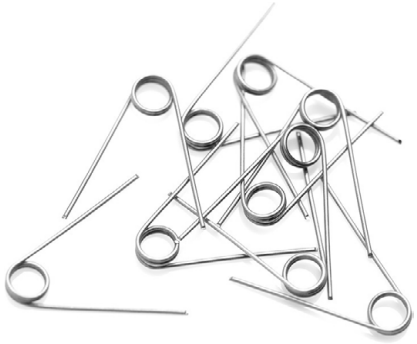
Gauze-retaining springs

Inserted and removed using the TubeMate tool, gauze-retaining springs ensure the rear sorbent-retaining gauze is correctly positioned on top of the sorbent bed in metal tubes.

Description	Part number
Gauze-retaining spring, pk 10	C-SP010
Gauze-retaining spring, pk 100	C-SP100

Torsion springs for glass tubes

Used in glass tubes, torsion springs ensure that the rear plug of quartz wool remains positioned correctly on top of the sorbent bed. They are also useful for securing material samples in the central heated zone of a tube during direct desorption.



Description	Part number
Spring, torsion, for 4 mm i.d. glass tubes, pk 10	C-GTSP10

To order any of these accessories, simply telephone or send an email.

Email: enquiries@markes.com **Web:** www.markes.com

Tools

CapLok™

Designed by scientists at INERIS in France, the CapLok tool simplifies tube capping and uncapping procedures, and minimises the risk of sample loss through incorrect capping, or tube damage through over-tightening.

Description	Part number
CapLok tool	C-CPLOK
CapLok tool, pk 10	C-10LOK

For more information on using the CapLok tool, see Application Note 019.

For details of TAGLok (an equivalent tool for tag-adapted storage caps), see page 16.

TubeMate™

TubeMate makes it easy to insert (and remove) gauze-retaining springs in metal tubes, and can also be used to position the rear sorbent-retaining gauze on the sorbent surface.

Description	Part number
TubeMate tool	C-TBMTE

Just contact Markes International if you have any questions on tube accessories.

Tube connection unions

Stainless steel unions fitted with one-piece PTFE ferrules make it easy to connect sorbent tubes in series, when necessary.

Tubes connected in this way are useful for monitoring breakthrough, or when collecting samples on sorbent combinations that cannot be packed into a single tube.

Description	Part number
Union, ¼″–¼″, stainless steel & ¼″ PTFE ferrule, pk 10	C-UNS10
Union, ¼″–¼″, stainless steel & ¼″ PTFE ferrule, pk 100	C-UNS100

Sorbent tube shipment boxes

Markes International provides two types of lightweight, robust cardboard storage boxes for convenient shipment of 3½″ steel or glass sorbent tubes:

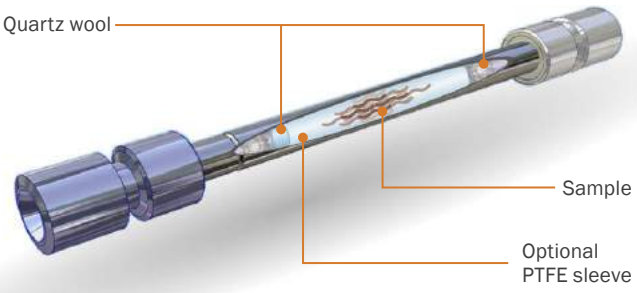
- For 10 unconditioned & uncapped tubes.
- For 10 conditioned & capped tubes.

Description	Part number
Box, for 10 unconditioned tubes, pk 10	C-BXU10
Box, for 10 conditioned tubes, pk 10	C-BXC10

Direct desorption

Direct desorption is a highly effective, cost-saving technique that can be used to rapidly screen small quantities of homogeneous solid (or semi-solid) materials.

Samples are simply weighed into empty TD tubes (using a **tube liner**[1] if needed), and placed in the thermal desorber. They are then heated in a stream of inert gas to dynamically extract headspace volatiles directly onto the focusing trap.



Direct desorption avoids labour-intensive manual sample preparation, and improves method stability by eliminating interferences such as non-volatiles, water and solvents prior to analysis.

Description	Part number
Glass tube, empty, restricted, pk 10	C0-NXXX-0000
Glass tube, empty, unrestricted, pk 10	C0-FXXX-0000
Stainless steel tube, empty, pk 10	C0-AXXX-0000
Inert-coated stainless steel tube, empty, pk 10	C0-CXXX-0000
Liner[1], PTFE, snug-fit, pk 10	C-PI010
Liner[1], PTFE, snug-fit, pk 100	C-PI100
Liner[1], PTFE, loose-fit, pk 10	C-PL010
Liner[1], PTFE, loose-fit, pk 100	C-PL100
Direct desorption starter kit	C-KITDD-2S

For a more detailed description of direct desorption, see Application Note 009.

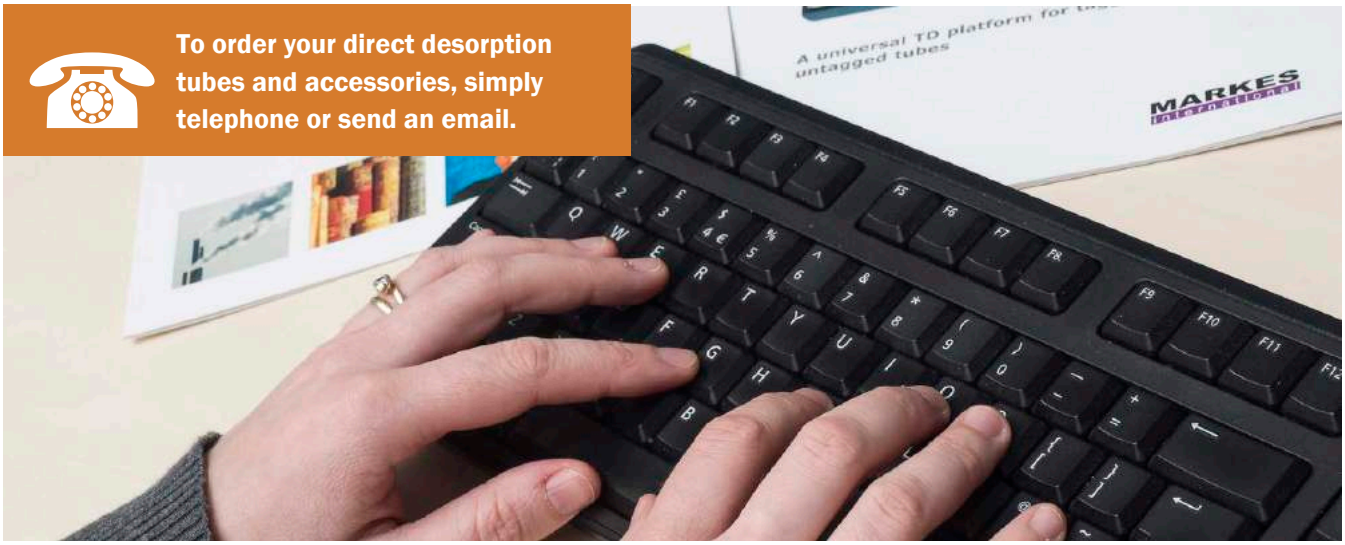
For examples of the use of direct desorption to analyse:

- **Paint and polymers – see Application Notes 057 and 108.**
- **Car trim (in accordance with VDA Method 278) – see Application Note 059.**

For details of Markes International's cost-effective direct desorption starter kit, see page 48.

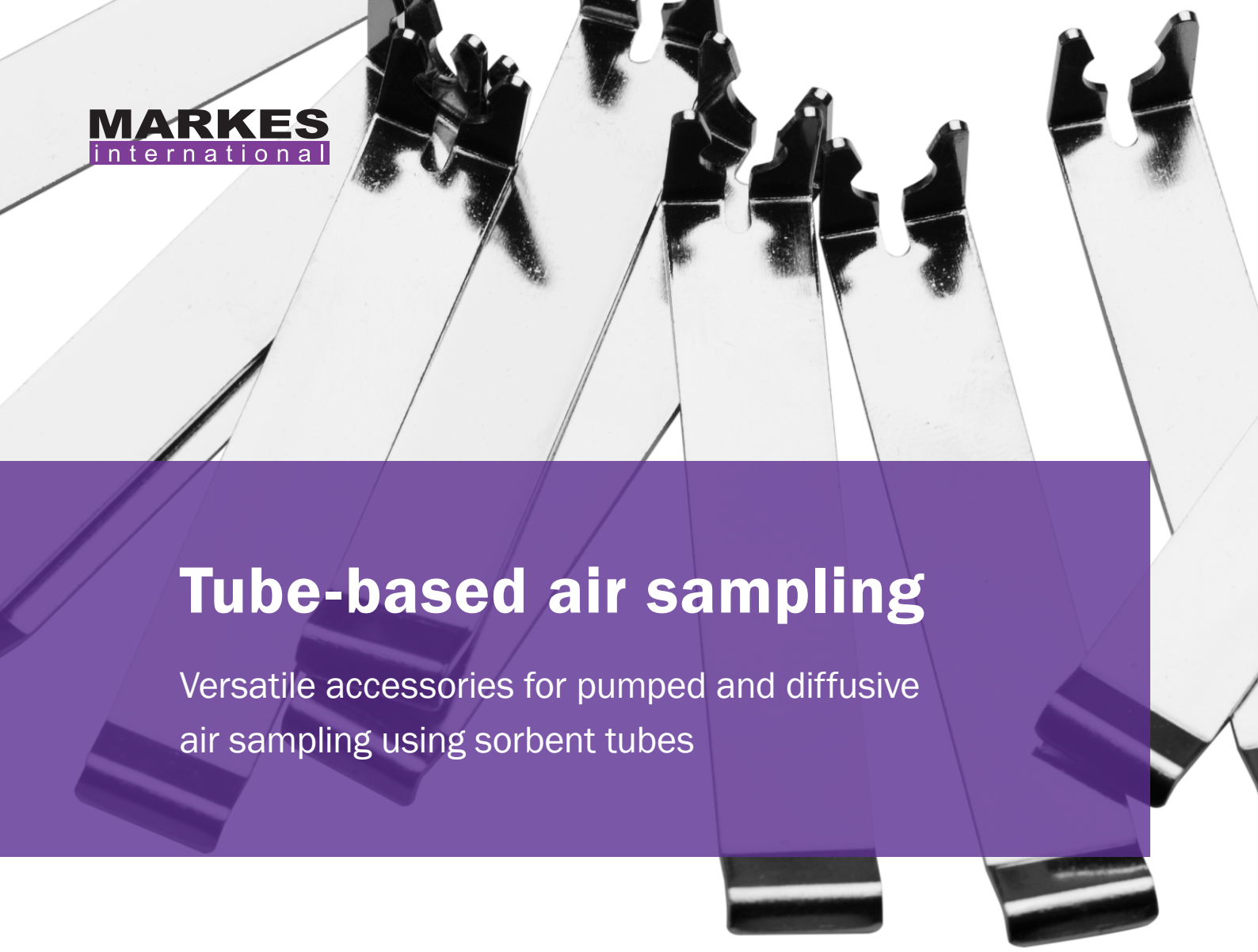
1. Liners are suitable for stainless steel tubes only.

To order your direct desorption tubes and accessories, simply telephone or send an email.



Email: enquiries@markes.com **Web:** www.markes.com

MARKES international



Tube-based air sampling

Versatile accessories for pumped and diffusive air sampling using sorbent tubes

Product highlights

- Precisely manufactured diffusion caps for accurate diffusive sampling
- New 325 Field Station™ for method-compliant refinery fenceline monitoring
- ACTI-VOC™ – personal monitoring pump specifically optimised for thermal desorption
- Easy-VOC™ – quick grab-sampling for stack gas and industrial air
- Portable sequential sampling with the MTS-32™

Contact Markes International for expert advice

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USA: 866-483-5684 (toll-free)
Germany: +49 (0)6102 8825569

Diffusive (passive) sampling

Diffusive sampling using sorbent tubes is a convenient, quantitative and inexpensive air monitoring option for applications ranging from personal exposure studies to routine monitoring of industrial and urban air.

Diffusion caps

Markes International's robust diffusion caps are made of anodised aluminium and fit on to the end of standard 3½″ metal tubes (see pages 8–9). Stainless steel caps are also available for more corrosive atmospheres. If enhanced traceability is required, Markes can also etch each diffusion cap with a unique serial number.

Description	Part number
Cap, diffusion, axial, aluminium, pk 10	C-DF010
Cap, diffusion, axial, aluminium, pk 100	C-DF100
Cap, diffusion, axial, aluminium, etched with serial number, pk 10	C-DF010E
Cap, diffusion, axial, aluminium, etched with serial number, pk 100	C-DF100E
Cap, diffusion, axial, stainless steel, pk 20	C-DFS20

Penclips

Penclips attach to the groove on 3½″ metal tubes, so that they can be easily fastened to a lapel or pocket for personal monitoring.

Description	Part number
Penclip, pk 10	C-CL010
Penclip, pk 100	C-CL100

For a detailed guide to diffusive monitoring, download Application Notes 008 and 010.

For details of Markes International's cost-effective Diffusive monitoring starter kit, see page 47.

US EPA Method 325

One of the most important applications of diffusive sampling is monitoring benzene and other hazardous VOCs in the air around oil refineries, in accordance with US EPA Method 325. Markes International provides a range of equipment and accessories that allow the fully method-compliant deployment of tube-based passive samplers, as well as sample analysis and tube cleaning.

325 Field Station™

This is a sturdy, non-emitting, weatherproof shelter for extended outdoor sorbent tube sampling, fully compliant with US EPA Method 325.

The 325 Field Station can accommodate up to five diffusive tubes for sampling of benzene and other hazardous VOCs, and is fully compatible with Markes' TubeTAG system (see page 15).

It can be supplied with a **325 Sun Shield™** (shown above), which ensures that the tubes within the Field Station do not overheat in strong sunshine.

Description	Part number
325 Field Station	C-325FS
325 Sun Shield	C-325SUN

For more information on Markes' Method 325 package, download Application Note 114, or visit www.markes.com.

Sorbent tubes and related accessories

Markes' specially developed **EPA 325 sorbent tube** can trap a range of compounds (including butadiene, benzene, toluene, ethylbenzene and xylenes), and can be supplied conditioned, capped and ready to use. Diffusion caps, which replace the storage cap when sampling commences, are available separately (see also page 22).

To protect the tubes before and after deployment, Markes International recommends the **325 Tube Container™**, which can accommodate 15 capped tubes, and fulfills the requirement of Method 325 to be air-tight and non-emitting.

When handling the large numbers of tubes required by Method 325, Markes International's patented **TubeTAG system** is recommended, to prevent manual transcription errors, optimise the audit trail and eliminate any risk of litigation (see also page 15). Tubes can be pre-fitted with the RFID tags, and a cost-effective starter kit is also available (see page 49).

Description	Part number
Sorbent tube, 'EPA 325', inert-coated stainless steel, pk 10	C1-CXXX-5020
Sorbent tube, 'EPA 325', inert-coated stainless steel, conditioned and capped, pk 10	C1-CAXX-5020
Sorbent tube, 'EPA 325', inert-coated stainless steel, fitted with TubeTAG, pk 10	C1-CXAX-5020
Sorbent tube, 'EPA 325', inert-coated stainless steel, conditioned and capped, fitted with TubeTAG, pk 10	C1-CCAX-5020
Cap, diffusion, axial, aluminium, pk 100	C-DF100
325 Tube Container (an air-tight, non-emitting container for 15 capped tubes), pk 2	C-325CT
TubeTAG starter kit	C-TAGKT

ACTI-VOC™ low-flow pump

ACTI-VOC is the only personal monitoring pump on the market that is optimised specifically for TD tubes. Being lightweight, compact and intrinsically safe, ACTI-VOC is ideal for personal, workplace and indoor air monitoring.

In addition, because it automatically compensates for sorbent packing density, ACTI-VOC delivers the same sampling flow (20–200 mL/min), irrespective of sorbent type or back-pressure, so minimising calibration frequency.

Description	Part number
ACTI-VOC low-flow pump kit (includes CapLok tool and carry-case)	C-LFP-01
Spare ACTI-VOC filter assembly	SERZ-1076
Spare ACTI-VOC bag sampling accessory	SERZ-1070
Spare ACTI-VOC charger	SERLFP-5002
Spare ACTI-VOC tube adaptor assembly	SERZ-1097
Spare ACTI-VOC back-pressure adaptor	SERLFP-5003

For more information on ACTI-VOC and Easy-VOC, download the respective brochures.

Easy-VOC™ grab-sampler

Markes International's manually-operated Easy-VOC allows simple and rapid 'grab-sampling' of precise volumes of air/gas directly onto sorbent tubes. With typical sampling volumes of 50–500 mL, key applications include industrial or workplace air monitoring.

Easy-VOC is also hassle-free, because it allows sampling of small air volumes without batteries or electrical power, and with minimal risk of analyte breakthrough.

Description	Part number
Easy-VOC pump kit (includes CapLok tool and carry-case)	C-EZVOCPO
Easy-VOC accessory pack	C-EZVOCAK

Contact Markes International to purchase these products, and for advice about optimum sampling flows for different applications.

Email: enquiries@markes.com **Web:** www.markes.com

MTS-32™ multiple-tube sampler

Markes International's MTS-32 is a compact, portable sampler perfect for unattended monitoring of ambient, indoor or workplace atmospheres over extended periods.

Air is continually drawn into the case and pumped sequentially through up to 32 standard (3½″) sorbent tubes. The flow rate is the same regardless of any impedance variation, ensuring consistent sampling across all 32 tubes.

For maximum confidence in results, all tubes should be sealed using Markes' DiffLok caps (see page 17), to prevent diffusive ingress or loss of volatiles.

A wide range of flow rates and sampling times, together with mains or battery-powered operation, make the MTS-32 suitable for a wide range of air monitoring applications.

Description	Part number
MTS-32 multiple tube sampler *Also requires constant-flow pump (e.g. ACTI-VOC low-flow pump), 12 V battery and charger, or mains power supply*	MTS-32
Power supply accessory for MTS-32	MTS-5011
12 V Battery assembly for MTS-32	MTS-5009
Mains charger for 12 V battery of MTS-32	MTS-5010
Cable assembly for connecting MTS-32 to external 12 V battery *Required if 12 V battery is not supplied by Markes*	MTS-5013
ACTI-VOC low-flow pump kit	C-LFP-01

Markes International's specialists recommend the ACTI-VOC pump for use with the MTS-32.

For more information on MTS-32, download the separate brochure.

MARKES international

Canister-based air sampling

Simple sampling for very volatile airborne organics

Product highlights

- Canisters for US EPA Methods TO-14 and TO-15
- Handy rack for convenient canister storage
- Canister cleaner for reliably accurate sampling

Please note that some of our canister products are only available in certain countries – please contact your local supplier or Markes' sales team for advice.

Contact Markes International for expert advice

Email
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www.markes.com

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Germany: +49 (0)6102 8825569

Air-monitoring canisters

Canisters complement sorbent tubes, by allowing quantitative sampling of the most volatile air pollutants such as C_2 hydrocarbons and freons.

The TO-Can and SilcoCan are available in 1 L and 6 L sizes, and are pre-fitted with a ¼″ three-port valve and a vacuum pressure gauge, reading from –30 to 122 inHg (–15 to 60 psi). All canisters are shipped clean and pressurised with contaminant-free nitrogen.

TO-Can® canisters

Optimised for US EPA Methods TO-14/TO-15 and ASTM D5466, these electropolished canisters contain high-quality metal-to-metal seals and a stainless steel diaphragm valve for the best possible performance.

Description	Part number
TO-Can with gauge and ¼″ valve, 1 L	C-TOCAN1
TO-Can with gauge and ¼″ valve, 6 L	C-TOCAN6

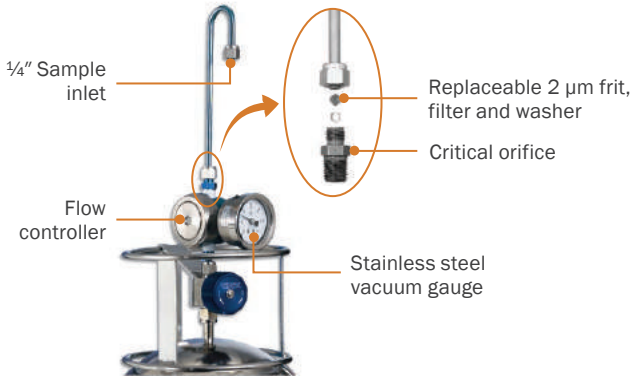
SilcoCan® canisters

Fitted with Siltek®-treated valves, these canisters offer unsurpassed inertness, even for brominated or sulfur-containing species.

Description	Part number
SilcoCan with gauge and Siltek ¼″ valve, 1 L	C-SLCAN1
SilcoCan with gauge and Siltek ¼″ valve, 6 L	C-SLCAN6

Canister kits and accessories

Easy to assemble in the field, Markes International's time-weighted-average (TWA) canister monitoring kits incorporate all necessary hardware for sampling over extended periods.



Description	Part number
TWA air sampling kit, stainless steel *Gives 1 h sampling from a 1 L canister or 8 h sampling from a 6 L canister*	C-ASK1168SS
TWA air sampling kit, Siltek-treated *Gives 1 h sampling from a 1 L canister or 8 h sampling from a 6 L canister*	C-ASK1168SL
Replacement 2 µm frit filter for critical orifice (includes washers), stainless steel, pk 3	C-ASK2USS
Replacement 2 µm frit filter for critical orifice (includes washers), Siltek-treated, pk 3	C-ASK2UST

For details of a gas standard suitable for US EPA Method TO-15, see page 36.

Email: enquiries@markes.com **Web:** www.markes.com

Canister rack

Markes International's space-saving Maxi Rack supports canisters attached to CIA *Advantage* analysers.

Floor-mounted, it holds up to 15 canisters (14 samples and one internal standard).

Description	Part number
Maxi Rack (1 L to 6 L canisters)	U-RACK02

For details of Markes International's cost-effective TO-15 starter kit, see page 47.

Canister cleaning system

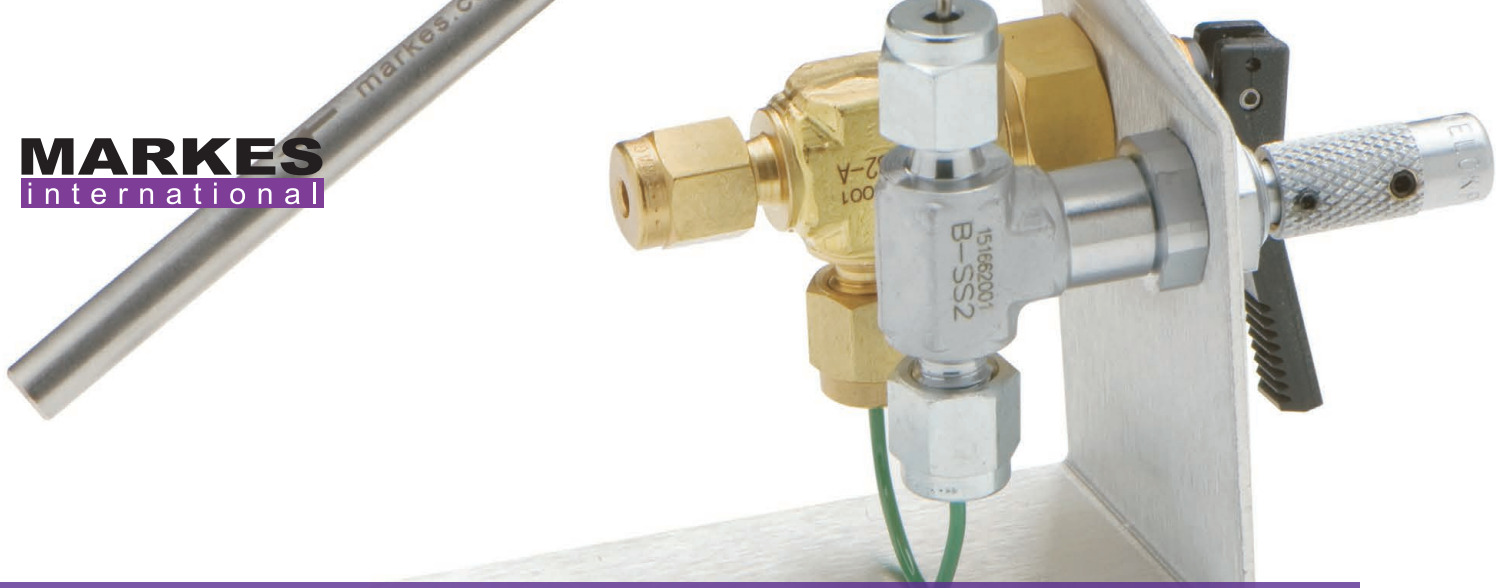
Compliant with US EPA Method TO-14/TO-15, this TO-Clean canister cleaning system is easily adapted for canisters of different sizes – from twelve 6 L canisters to 48 miniature canisters – and at temperatures up to 110°C.

The system is fully automated, allowing you to start a cleaning cycle and walk away. Up to ten custom cleaning methods can be defined and loaded, while consistently high performance is ensured by the automated leak-check method.

Description	Part number
TO-Clean canister cleaning system with isothermal oven (120 V a.c.)	U-TOCLN120
TO-Clean canister cleaning system with isothermal oven (220–240 V a.c.)	U-TOCLN220
1 L bracket for TO-Clean, pk 12	C-TOCLN1L

For examples of canister sampling to monitor 'air toxics', ozone precursors and perfluorocarbons, download Application Notes 081 and 099.

Contact Markes International to discuss your canister application and how Markes' technologies can provide improved performance.



Calibration and standards

Standards and accessories for reliable, quantitative thermal desorption

Product highlights

- Calibration Solution Loading Rig – the easiest way to calibrate your TD system
- Specially packed tubes for loading liquid-phase external standards
- Handy check-standards for instrument set-up and troubleshooting
- Expert-prepared certified reference standard tubes for routine quality assurance
- High-quality standards for calibration of tube and canister systems

Contact Markes International for expert advice

Email
enquiries@markes.com

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UK: +44 (0)1443 230935
USA: 866-483-5684 (toll-free)
Germany: +49 (0)6102 8825569

Calibration Solution Loading Rig

Markes International's Calibration Solution Loading Rig (CSLR™) has been specifically designed for loading sorbent tubes with gas- or liquid-phase standards. With an unheated injector port, it also complies with key TD standard methods such as ISO 16017, US EPA Method TO-17 and ASTM D6196.

Operation is simple – with the packed sorbent tube connected to the CSLR, the standard is injected through the septum, allowing the compounds to be swept onto the tube in a stream of carrier gas.

Description	Part number
Calibration Solution Loading Rig	C-CSLR
Septum, 9.5 mm (for CSLR), pk 10	C-SPTA

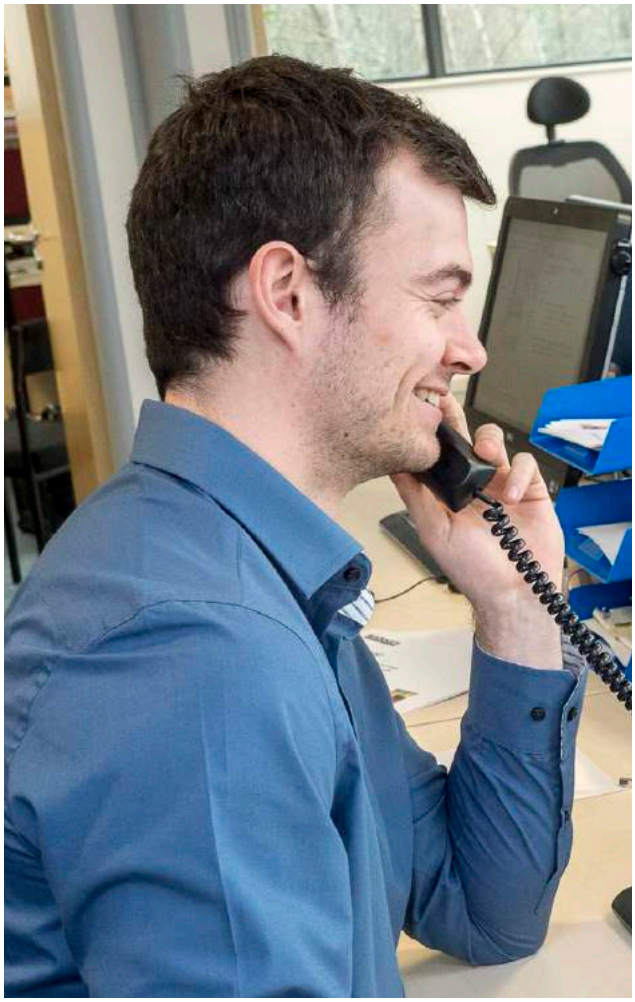
A single regulator pneumatics accessory is needed for use with the CSLR – see page 58 for details.

For more information on routine calibration of TD methods, download Application Notes 007 and 075.

Liquid-phase external calibration tubes

When it is difficult to introduce liquid standards in a stream of carrier gas, a convenient alternative is to inject them directly onto these glass sorbent tubes specially packed with a short bed of Tenax TA and quartz wool.

Description	Part number
Tube, glass, Tenax TA, 1 cm calibration, pk 10	C1-BXXX-5072
Tube, glass, Tenax TA, 1 cm calibration, conditioned and capped, pk 10	C1-BAXX-5072



Email: enquiries@markes.com **Web:** www.markes.com

Check-standard tubes

Check-standard tubes contain a range of routine and challenging analytes for troubleshooting and quality assurance. Markes International supplies two types of check-standard, both prepared on high-quality conditioned Tenax TA sorbent tubes.

Instrumentation check-standard tubes

These contain benzene, toluene, *o*-xylene, isobornyl methacrylate (IBMA) and dioctyl phthalate at a nominal concentration of 90 ng/µL for each component. A single check-standard tube is supplied with all Markes' systems.

Description	Part number
Check-standard (BTX, IBMA and dioctyl phthalate), 90 ng/µL (nominal), Tenax TA, pk 10	C-CHK10

Material emissions check-standard tubes

These enhance validation and quality control for laboratories using TD–GC methods to test chemical emissions from products and materials. The sorbent tubes are pre-loaded with n-hexane, 4-methylpentan-2-one (MIBK), toluene, n-butyl acetate, cyclohexanone, phenol, 1,2,3-trimethylbenzene, 4-phenylcyclohexene and n-hexadecane, at a nominal loading of 100 ± 10 ng per compound. The standard complies with ISO 17025 for loading tubes (also in accordance with ISO 9001).

Description	Part number
Check-standard (material emissions), 100 ng per tube (nominal), Tenax TA, pk 10	C-CHK10-ME

To order the CSLR, calibration tubes or check-standards, simply telephone or send an email.

Do you participate in a proficiency testing scheme for TD?

As part of our service to customers, Markes likes to make thermal desorption users aware of complementary third-party services that could be of interest and benefit. Proficiency testing (PT) schemes are a case in point.

PT schemes for thermal desorption work by providing participating laboratories with spiked tubes for analysis. The tubes are analysed by these laboratories, as part of their routine operation, and the results reported to the scheme organisers. The laboratories involved are then provided with a report showing how closely their results agree with the accepted values. Reports are confidential, as results are given by laboratory identification number, known only to the organiser and the individual laboratories.

Regular participation in a proficiency-testing scheme:

- Provides a laboratory with an important independent insight into their performance.
- Benchmarks laboratory performance against other scheme participants.
- Allows laboratories to demonstrate commitment to measurement quality to regulatory agencies, accreditation bodies and laboratory customers.

The AIR PT scheme

One of the most popular schemes for thermal desorption is the AIR PT scheme. This tests the performance of laboratories measuring exposure to hazardous chemical substances in the ambient, indoor and workplace air environments using TD methods. The scheme was established in 1988 as the Workplace Analysis Scheme for Proficiency (WASP), and currently has more than 350 laboratory participants worldwide. The WASP scheme is operated by LGC Standards (which oversees management, registration, data analysis, publishing reports, membership and distribution), working in partnership with the UK Health & Safety Laboratory (who provide technical expertise, support, and produce the dynamically loaded TD tubes and filters).

AIR PT offers the following samples for the analysis of thermal desorption tubes:

Application	Testing environment	Analytes	Loading
Ambient air	ISO 16017-1 & 2, US EPA TO-17	BTEX	15–300 ng †
Indoor air and material emissions	ISO 16000-6	Up to 13 VOCs and SVOCs	25–1000 ng
Workplace air	ISO 16017-1 & 2	BTEX	0.5–200 µg †
	ISO 16000-3	Formaldehyde	1.5–60 µg ‡

† Analytes provided together on a TD sorbent tube packed with Tenax TA. Test samples dynamically loaded from a standard atmosphere based upon procedures set out in ISO 6145-4.

‡ Glass fibre filter spiked with DNPH derivative. Note this requires HPLC, and is not compatible with TD–GC(–MS) methods.

If you are interested in AIR PT, please contact LGC Standards on +44 (0)161 762 2500 or at ptcustomerservices@lgcgroup.com.

Certified reference standard (CRS) tubes

Markes International's CRS tubes are prepared by an expert national standards laboratory following approved methodology (ISO 6145 parts 4 or 8, accredited to ISO 17025), and are certified traceable to primary standards.

Routine use of these CRS tubes complies with guidance given in international standard methods, and provides continual quality assurance of system and procedure reliability.

All CRS tubes are supplied with a shipping blank tube, and are wrapped in aluminium foil prior to shipment in air-tight boxes, offering ultimate protection. A chromatogram of the shipping blank tube is supplied, together with a certificate of standard traceability. BTX and TO-17 standard tubes are supplied with an example chromatogram and full user instructions.

BTX CRS tubes

Tenax TA tubes loaded with benzene, toluene and *o*-xylene at 100 ng per component are suitable for the majority of environmental applications, and have a certified shelf-life of 6 months.

Description	Part number
CRS (BTX), 100 ng, pk 10	C-BTX100-10

TO-17 CRS tubes

A TO-17 CRS tube is available loaded with nine components typical of those found during air toxics monitoring, namely:

Benzene
Toluene
o-Xylene
1,2,4-Trimethylbenzene
Dichloromethane
1,1,1-Trichloroethane
Methyl *tert*-butyl ether
Methyl ethyl ketone
Ethyl acetate

These standard tubes are prepared on conditioned Tenax TA tubes at 100 ng per component, and have a certified shelf-life of 6 months.

Description	Part number
CRS (TO-17), 100 ng, pk 10	C-TO17100-10

Custom CRS tubes

If you require a special combination of stable chemicals pre-loaded onto conditioned sorbent tubes, Markes International also offers a custom CRS tube service. Up to eight compounds can be specified, with the sorbent typically being Tenax TA (although others are available). Please discuss your requirements with a Markes specialist prior to ordering (a minimum order quantity may apply).

Description	Part number
CRS (custom), pk 10	C-CUST-10

Internal standards

Suitable for all Markes International's TD instruments, Markes' 1 ppm internal gas standard is perfect for complying with US EPA Methods TO-14/TO-15/TO-17 and other TD–GC–MS applications.[1]

The cylinder (110 L, 1800 psig) is of aluminium construction (8.3 cm × 29.5 cm), is PI-marked for compliance with EU transport regulations and US DOT specification 3AL2216, and contains the following components:

Bromochloromethane
1-Bromo-4-fluorobenzene
Chlorobenzene-d_5
1,4-Difluorobenzene

Description	Part number
Standard, gas cylinder, TO-14A IS/tuning mix, 1 ppm	C-GS14A-1PPM
Regulator, high-purity VOC, 0–100 psi outlet	C-GSREG-100
Tubing, stainless steel, ⅛″, to connect IS to ISDP	SERZ-0022

For details of Markes International's cost-effective TO-15 and TO-17 starter kits, see page 47.

1. Please note that this product may be unavailable in certain countries – please contact Markes International for more information.

For advice on any aspect of calibration or standards, contact Markes International's technical specialists.

Gas standards for external method calibration

Markes International also offers two high-quality gas standards suitable for a variety of canister- and tube-based environmental air monitoring methods.

The standards are contained in aluminium cylinders (8.3 cm × 29.5 cm) and are PI-marked for compliance with EU transport regulations and US DOT specification 3AL2216.

TO-15 'Air toxics'/TO-17 65-component mix – 1 ppm[1]

Supplied in nitrogen at 1800 psig. Injecting 1 mL of this mix onto a sorbent tube or cold trap introduces 2–4 ng of the following components:

Acetone
Acrolein
Benzene
Benzyl chloride[2]
Bromodichloromethane
Bromoform
Bromomethane
Butadiene
Butan-2-one (methyl ethyl ketone)
Carbon disulfide[2]
Carbon tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
Cyclohexane
Dibromochloromethane
1,2-Dibromoethane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Dichlorodifluoromethane (Freon® 12)
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene
trans-1,2-Dichloroethene
Dichloromethane
1,2-Dichloropropane
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
1,2-Dichlorotetrafluoroethane (Freon® 114)
1,4-Dioxane
Ethanol[2]
Ethyl acetate
Ethylbenzene
4-Ethyltoluene
Heptane
Hexachlorobutadiene
Hexane
Hexan-2-one (methyl butyl ketone)
Methyl methacrylate
4-Methylpentan-2-one (methyl isobutyl ketone)
Methyl *tert*-butyl ether
Naphthalene
Propan-2-ol
Propene
Styrene
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Tetrahydrofuran
Toluene
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Trichlorofluoromethane (Freon® 11)
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon® 113)
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
Vinyl acetate
Vinyl chloride
m-Xylene
o-Xylene
p-Xylene

Description	Part number
Standard, gas cylinder, TO-15, 65-component mix, 1 ppm	C-GS15-1PPM
Regulator, high-purity VOC, 0–100 psi outlet	C-GSREG-100

Ozone precursor/PAMS 57-component mix – EPA concentrations 20–60 ppbC[1,3]

Supplied in nitrogen at 1800 psig. Injecting 1 mL of this mix onto a TD cold trap introduces approximately 0.1 ng of the components below (individual concentrations in ppbC[3] are given in parentheses).

Acetylene (40)
Benzene (30)
n-Butane (40)
But-1-ene (30)
cis-But-2-ene (35)
trans-But-2-ene (25)
Cyclohexane (40)
Cyclopentane (20)
n-Decane (30)
m-Diethylbenzene (40)
p-Diethylbenzene (25)
2,2-Dimethylbutane (40)
2,3-Dimethylbutane (50)
2,3-Dimethylpentane (50)
2,4-Dimethylpentane (40)
n-Dodecane (40)
Ethane (25)
Ethylbenzene (25)
Ethene (20)
m-Ethyltoluene (25)
o-Ethyltoluene (30)
p-Ethyltoluene (40)
n-Heptane (25)
n-Hexane (30)
Hex-1-ene (60)
Isobutane (25)
Isopentane (40)
Isoprene (40)
Isopropylbenzene (40)
Methylcyclohexane (30)
Methylcyclopentane (25)
2-Methylheptane (25)
3-Methylheptane (25)
2-Methylhexane (25)
3-Methylhexane (25)
2-Methylpentane (20)
3-Methylpentane (40)
n-Nonane (25)
n-Octane (30)
n-Pentane (25)
Pent-1-ene (25)
cis-Pent-2-ene (35)
trans-Pent-2-ene (25)
Propane (40)
n-Propylbenzene (30)
Propene (25)
Styrene (40)
Toluene (40)
1,2,3-Trimethylbenzene (25)
1,2,4-Trimethylbenzene (40)
1,3,5-Trimethylbenzene (25)
2,2,4-Trimethylpentane (30)
2,3,4-Trimethylpentane (25)
n-Undecane (30)
o-Xylene (25)
m/*p*-Xylene (combined) (40)

Note that this standard contains some very volatile analytes, and is not suitable for loading onto standard sorbent tubes at ambient temperature.

Description	Part number
Standard, gas cylinder, O_3/PAMS, 57-component mix, EPA concentration, 20–60 ppb	C-GSPAMS-EPA
Regulator, high-purity VOC, 0–100 psi outlet	C-GSREG-100

1. Please note that this product may be unavailable in certain countries – please contact Markes International for more information.
2. Note that the stability of these compounds cannot be guaranteed.
3. ppbC = parts per billion expressed as carbon.

MARKES international

Sampling accessories

An extensive range of sampling accessories for every TD application

Product highlights

- Micro-Chamber/Thermal Extractor™ for quick emissions screening
- HiSorb™ probes and accessories for efficient immersive and headspace sorptive extraction
- SPE-tD™ cartridges for simple sorptive extraction from liquids
- Easy-to-use Bio-VOC™ breath sampler
- Cost-effective soil gas monitoring with the VOC-Mole™ soil probe

Contact Markes International for expert advice

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Micro-Chamber/Thermal Extractor™

Markes International's Micro-Chamber/Thermal Extractor (µ-CTE™) is the ultimate system for sampling chemical emissions and odour profiles from a wide range of products and materials, quickly and reliably.

It accommodates up to six samples, and is used in conjunction with a TD–GC system to screen multiple samples quickly and cost-effectively. Applications range from routine quality assurance of manufactured goods to rapid aroma profiling of foods and fragranced products.

The µ-CTE is available in two models: the six-chamber model (max. 120°C, with 44 cm^3 chambers) and the four- chamber model (max. 250°C, with 114 cm^3 chambers).

Each is compatible with accessories that allow:

- Use of humidified air or gas.
- Permeation testing.
- Assessment of surface emissions.
- Formaldehyde sampling.
- Sampling from liquid or resinous samples.

Part numbers for the 6-chamber µ-CTE (max. 120°C)

Description	Part number
Micro-Chamber/Thermal Extractor, 6-chamber, inert	M-CTE120I
Micro-Chamber/Thermal Extractor, 6-chamber, inert, with 6 toggle valves	M-CTE120TI
Starter kit for Micro-Chamber/Thermal Extractor, inert	M-STUKTI
Sample pan, inert, pk 6	M-MCHSI
Removable lid, inert, pk 6	M-MCTOPI

Part numbers for the 4-chamber µ-CTE (max. 250°C)

Description	Part number
Micro-Chamber/Thermal Extractor, 4-chamber, inert	M-CTE250I
Micro-Chamber/Thermal Extractor, 4-chamber, inert, with 4 toggle valves	M-CTE250TI
Starter kit for Micro-Chamber/Thermal Extractor, inert	M-STUKT250I
Sample pan, inert, pk 4	M-MCHSS250I
Removable lid, inert, pk 4	M-MCTOP250I

For advice on how the µ-CTE can aid compliance with construction products regulations, please contact Markes International's technical specialists.

For examples of the µ-CTE being used to sample volatiles from:

- **Soil – see Application Note 080.**
- **Car trim – see Application Note 093.**
- **Cheese – see Application Note 101.**
- **Building materials – see Application Note 103.**

Part numbers for the 6-chamber µ-CTE (max. 120°C)

Description	Part number
Humidifier accessory	
Humidifier accessory for Micro-Chamber/ Thermal Extractor	M-HUMID-MCTE
Accessories for permeation testing	
Permeation accessory, stainless steel, pk 1	M-PRMIN1
Permeation accessory, stainless steel, pk 6	M-PRMIN
Permeation accessory, inert, pk 1	M-PRMINSS1-120
Permeation accessory, inert, pk 6	M-PRMINSS-120
O-Ring, 30 mm o.d., permeation accessory seal, pk 6	M-PRO30-120
Septum, ¼″, for permeation accessory injection port, pk 6	M-PRSPT-120
Accessories for surface emissions testing	
Collar spacer, Al, 15 mm, pk 6	M-SPC15-120
Collar spacer, Al, 5 mm, pk 6	M-SPC05-120
Spacer disc, Al, 1.5 mm, pk 24	M-DSK15-120
Adjustable sprung spacer, pk 6	M-SPGSC-120
Accessories for formaldehyde sampling[1]	
O-Ring, size 007, and spacer, to connect 4 mm Luer cartridge, pk 6 (for DNPH cartridges)	M-TCN04
Other accessories	
Sample disc, 1.0 mm thickness, PTFE, pk 6	M-DSKPF
Insert for liquid standard introduction, PTFE, pk 6	M-TSTIN
Routine maintenance kit for Micro-Chamber/ Thermal Extractor	RMK-0006
Pneumatics accessory (single regulator)[2]	U-GAS03
O-Ring, size 010, to connect ¼″ o.d. tubes, pk 6 (for standard tubes)	M-TCN64
O-Ring, 5.92 mm i.d., to connect 6 mm o.d. tubes, pk 6	M-TCN06
O-Ring, size 006, for gas line connection to removable lid, pk 6	M-MC006
Tube interface cap for removable lid, pk 6	M-TICAP
O-Ring, micro-chamber pan seal, pk 6	M-MCHOR

For more information on the µ-CTE and associated accessories, download the separate brochure.

For details of cost-effective µ-CTE starter kits, see page 50.

Part numbers for the 4-chamber µ-CTE (max. 250°C)

Description	Part number
Humidifier accessory	
Humidifier accessory for Micro-Chamber/ Thermal Extractor	M-HUMID-MCTE
Accessories for permeation testing	
Permeation accessory, stainless steel, pk 1	M-PRMIN1-250
Permeation accessory, stainless steel, pk 6	M-PRMIN-250
Permeation accessory, inert, pk 1	M-PRMINSS1-250
Permeation accessory, inert, pk 4	M-PRMINSS-250
O-Ring, 30 mm o.d., permeation accessory seal, pk 4	M-PRO30-250
Septum, ¼″, for permeation accessory injection port, pk 6	M-PRSPT-250
Accessories for surface emissions testing	
Collar spacer, Al, 15 mm, pk 4	M-SPC15-250
Collar spacer, Al, 5 mm, pk 4	M-SPC05-250
Spacer disc, Al, 1.5 mm, pk 24	M-DSK15-250
Adjustable sprung spacer, pk 4	M-SPGSC-250
Accessories for formaldehyde sampling[1]	
O-Ring, size 007, and spacer, to connect 4 mm Luer cartridge, pk 6 (for DNPH cartridges)	M-TCN04
Other accessories	
Sample disc, 1.0 mm thickness, PTFE, pk 6	M-DSKPF
Insert for liquid standard introduction, PTFE, pk 6	M-TSTIN
Routine maintenance kit for Micro-Chamber/ Thermal Extractor	RMK-0006HT
Pneumatics accessory (single regulator)[2]	U-GAS03
O-Ring, size 010, to connect ¼″ o.d. tubes, pk 6 (for standard tubes)	M-TCN64
O-Ring, 5.92 mm i.d., to connect 6 mm o.d. tubes, pk 6	M-TCN06
O-Ring, size 006, for gas line connection to removable lid, pk 6	M-MC006
Tube interface cap for removable lid, pk 6	M-TICAP
O-Ring, micro-chamber pan seal, standard (for applications <200°C), pk 4	M-MCHOR250
O-Ring, micro-chamber pan seal, ultra-high purity standard (for applications >200°C), pk 4	M-MCHOR250-HT

1. DNPH cartridges are not included.
2. Markes recommends that a pneumatics accessory (U-GAS03, page 58) is used with every µ-CTE.

HiSorb sorptive extraction probes

HiSorb is an innovative, labour-saving sampling system for the analysis of volatile and semi-volatile organic compounds (VOCs and SVOCs) in liquids and solids by TD–GC–MS.

HiSorb is far quicker and easier to use than solvent extraction (see workflow below), and completely avoids the cost of solvent consumption and disposal.

It also offers lower detection limits than for solid-phase micro-extraction (SPME), due to the larger capacity of the sorbent and the use of TD pre-concentration and automated GC–MS analysis.

These advantages make HiSorb probes and accessories ideal for aroma profiling, quality control and advanced research across a wide range of applications.

1

Probe insertion:
Two probe lengths allow immersive or headspace sampling in 20 or 10 mL vials.

2

Analyte extraction:
The HiSorb Agitator efficiently mixes and heats the sample to facilitate extraction.

3

Probe washing:
Probes are washed and dried to remove residual matrix.

4

Analysis:
The HiSorb probe is inserted into a standard TD tube for analysis by TD–GC–MS.

HiSorb probes

HiSorb probes are used to sorptively extract VOCs and SVOCs from a range of sample types. They can be used for immersive or headspace sampling from water-based solutions, emulsions and suspensions, as well as headspace sampling from solids.

The probes are available manufactured from regular or inert-coated stainless steel, and are fitted with a section of polydimethylsiloxane (PDMS) that allows high-capacity sorptive extraction of a wide range of VOCs and SVOCs.

Standard-length (75 mm) probes are available for immersive sorptive extraction from liquids in 20 mL headspace vials. Short-length (55 mm) probes are suitable for immersive extraction from 10 mL vials, or headspace extraction from 20 mL vials.

All the probes are compatible with TD–GC–MS analysis using industry-standard 3½″ × ¼″ tubes on all leading commercial systems. They are easy to use, robust and re-usable, minimising the cost per sample.

Description	Part number
HiSorb-P1 probe assembly, stainless steel, standard length, pk 5	H1-XXAAC-5
HiSorb-P1 probe assembly, stainless steel, short length, pk 5	H1-XXABC-5
HiSorb-P1 probe assembly, inert-coated stainless steel, standard length, pk 5	H1-AXAAC-5
HiSorb-P1 probe assembly, inert-coated stainless steel, short length, pk 5	H1-AXABC-5

HiSorb Agitator

The HiSorb Agitator is an efficient laboratory agitation unit for up to 16 headspace vials (2, 10 or 20 mL), with control of speed, incubation temperatures and agitation time.

The HiSorb Agitator can be used in conjunction with Markes' HiSorb probe technology for sorptive sample extraction,[1] and as a stand-alone unit for general laboratory mixing of liquids or solid suspensions – including incubation, agitation, derivatisation and extraction.

Sample blocks are detachable from the base unit, enabling sample preparation anywhere within the laboratory. The loaded sample block is then easily remounted on the agitator, without any tools.

Description	Part number
HiSorb Agitator, with 16 × 20 mL vial block	U-HSAG-20
Additional vial block, 16 × 20 mL	U-HSVB-20

To order any HiSorb parts, simply telephone or send an email.

HiSorb accessories

Headspace vials (20 mL and 10 mL) with crimp-top sealing come in cost-effective packs of 100.

The versatility of the HiSorb Agitator can be increased by using interchangeable **vial block inserts** to securely hold 2 mL and 10 mL vials in place within each well.

Empty TD tubes are used to hold HiSorb probes while they are thermally desorbed.

A **probe extraction device** firmly holds the end of the HiSorb probe during the transfer from vial to sorbent tube, eliminating any risk of contamination through manual handling.

Vial sealing plugs prevent the evaporative loss of hazardous or odorous samples after extraction, by sealing the hole through which the HiSorb probe is introduced.

Description	Part number
Vial, 20 mL, crimp-top, glass, round-bottomed, pk 100	C-HSVC20-100
Vial, 10 mL, crimp-top, glass, round-bottomed, pk 100	C-HSVC10-100
HiSorb-P1 cap & septum, for 10/20 mL crimp vial, pk 50	C-HSCSC-20C-50
Vial block insert, 20 mL to 2 mL, pk 4	C-HSINS2-4
Vial block insert, 20 mL to 10 mL, pk 4	C-HSINS10-4
Stainless steel tube, empty, pk 10	C0-AXXX-0000
Inert-coated stainless steel tube, empty, pk 10	C0-CXXX-0000
HiSorb-P1 extraction device	VC-HSPH
HiSorb-P1, vial sealing plug, pk 5	C-HSVLP-5
HiSorb-P1 starter kit, inert	C-HSPKIT

For details of Markes International's cost-effective HiSorb starter kit, see page 49.

1. Note that HiSorb probes cannot be used with 2 mL vials.

SPE-tD™ sorptive extraction cartridges

Markes International's SPE-tD sorptive extraction cartridges are a simple way of sampling less volatile impurities in aqueous samples – applications that would otherwise require manually intensive extraction or distillation before GC analysis.

SPE-tD cartridges are constructed in the form of a hollow tube, coated inside and out with poly(dimethylsiloxane) (PDMS), and operate on the same physical principles as HiSorb probes. The cartridge is simply placed into the sample and agitated, before being removed, rinsed, and placed into an empty TD tube for analysis.

Description	Part number
SPE-tD cartridge (30 mm), pk 1	C-SPTD1
SPE-tD cartridge (30 mm), pk 5	C-SPTD5
SPE-tD cartridge (30 mm), pk 10	C-SPTD10
SPE-tD cartridge (6 mm), pk 1	C-SPTD1-6MM
SPE-tD cartridge (6 mm), pk 5	C-SPTD5-6MM
SPE-tD cartridge (6 mm), pk 10	C-SPTD10-6MM
Starter kit for SPE-tD	C-KITSP-2S

For details of Markes International's cost-effective SPE-tD starter kit, see page 49.

To order any of these products, simply telephone or send an email.

Bio-VOC™ breath sampler

Markes International's Bio-VOC is a simple, disposable device for collecting alveolar (end-tidal) breath samples and transferring them quantitatively to sorbent tubes. It is used for non-invasive biological exposure monitoring of VOCs.

Constructed of safe, non-emitting plastic, and based on pioneering work carried out at the UK Health & Safety Laboratory, the Bio-VOC can be operated with minimal training, and without medically qualified staff in attendance.

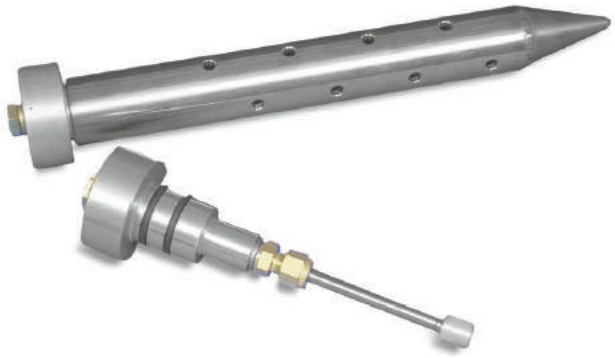
Description	Part number
Bio-VOC breath sampler, pk 1	C-BIO01
Bio-VOC breath sampler, pk 10	C-BIO10
Bio-VOC breath sampler, pk 50	C-BIO50
Bio-VOC breath sampler, pk 100	C-BIO100
Disposable cardboard mouthpiece, pk 100	C-B100M

For more information on Bio-VOC and example applications, download Application Note 013.

VOC-Mole™ soil probe

With a robust, high-quality stainless steel construction, Markes International's VOC-Mole is an economical way to sample VOCs in contaminated land, or along fuel pipelines.

Monitoring typically uses diffusive tubes held inside the VOC-Mole, but pumped sampling is also possible. The VOC-Mole is available in three probe lengths, and there is also a modified version for use in marshy ground.



Description	Part number
VOC-Mole assembly, 29.5 cm long, pk 1	P-00001
VOC-Mole assembly, 29.5 cm long, pk 10	P-00010
VOC-Mole assembly, 44.5 cm long, pk 10	P-00020
VOC-Mole assembly, 89.5 cm long, pk 10	P-00030
VOC-Mole assembly, 89.5 cm long, modified for use in marshy ground, pk 10	P-00040
VOC-Mole cap assembly, pk 1	P-CP001
VOC-Mole cap assembly, pk 10	P-CP010
Brass impact former for driving soil probes into the ground	P-FORMR
O-Ring, for VOC-Mole cap assembly, 23 mm × 3 mm i.d., pk 20	P-CP020
Union, for VOC-Mole cap assembly, pk 10	P-CPU10
Blanking plug, for VOC-Mole cap assembly, pk 10	P-CPP10
Dowty seal, for VOC-Mole cap assembly, pk 20	P-CPS20
Ferrule, PTFE, for VOC-Mole cap assembly, pk 10	P-CPF10

For more information on VOC-Mole and example applications, download Application Note 029.

Thermal analysis and evolved gas collection

Thermal desorption is a convenient way of investigating the gases evolved during thermogravimetric analysis (TGA), using these specially designed sorbent-packed MacroTubes™.

Description	Part number
MacroTube, general screening (C_5 to C_{30}), conditioned and capped, pk 5	E-MATBG5
MacroTube, high volatility (C_3 to C_{10}), conditioned and capped, pk 5	E-MATBV5
Macro connector	E-MACNT
Macro connector carrier	E-MACAR

Custom solutions

Over the years, Markes International has developed custom solutions for numerous TD users – from special-dimension DAAMS tubes to tailored TubeTAG data-input screens and multiple application-specific sampling accessories.

Whatever your requirements, Markes' specialists would be delighted to work with you to develop a custom solution precisely meeting your needs.

Talk to Markes International's specialists to discuss custom solutions for your application.

Starter kits

Handy packages of tubes, traps, tools and accessories to get you up and running quickly

Product highlights

- General-purpose TD starter kits for all current UNITY™ and TD100™ models
- Specialist kits for military, environmental and material emissions applications
- Convenient kits for specific instruments and accessories

Contact Markes International for expert advice

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Markes' general TD starter kits

Two economical general-purpose starter kits (with 3½″ tubes) are available for UNITY-xr and TD100-xr users.

Description	Part number
Basic TD starter kit	C-KIT012-2S
Advanced TD starter kit	C-KIT03-2S

The **Basic TD starter kit** contains:

Sorbent tube, Tenax TA, stainless steel, conditioned and capped, pk 10 *Suitable for pumped sampling of VOCs from C_6 to C_{30}*	C1-AAXX-5003
CapLok tool for tightening and undoing ¼″ brass storage caps	C-CPLOK
Cold trap, 'General-purpose carbon' *Compatible with the simultaneous analysis of analytes from $C_{4/5}$ to $C_{30/32}$*	U-T11GPC-2S
Quick-seal column connector, pk 10	C-QSC10

The **Advanced TD starter kit** contains:

Sorbent tube, 'Universal', stainless steel, conditioned and capped, pk 10 *Suitable for pumped sampling of VOCs from $C_{2/3}$ to C_{30}*	C3-AAXX-5266
Sorbent tube, Tenax TA, stainless steel, conditioned and capped, pk 10 *Suitable for pumped or diffusive sampling of VOCs from C_6 to C_{30}*	C1-AAXX-5003
Ferrule, ¼″ PTFE, pk 20	C-FP020
Cold trap, 'General-purpose carbon' *Compatible with the simultaneous analysis of analytes from $C_{4/5}$ to $C_{30/32}$*	U-T11GPC-2S
Easy-VOC pump, including CapLok tool and carry-case	C-EZVOCPO
Check-standard (BTX, isobornyl methacrylate (IBMA) and dioctyl phthalate), 90 ng/µL (nominal), Tenax TA, pk 10	C-CHK10
CapLok tool for tightening and undoing ¼″ brass storage caps	C-CPLOK
Quick-seal column connector, pk 10	C-QSC10

Application-specific starter kits

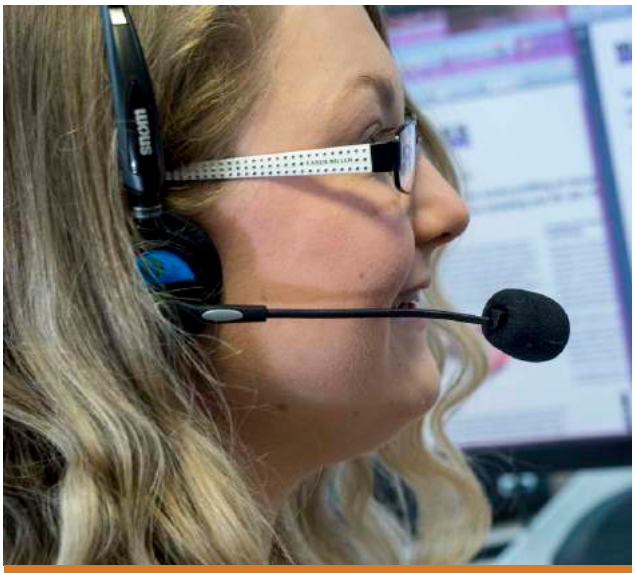
Military and homeland defence applications

Markes International offers a starter kit specifically for analysts in the field of military and homeland defence, which is compatible with standard UNITY-xr or TD100-xr systems.

Description	Part number
CWA starter kit	C-KITCW-2S

The **CWA starter kit** contains:

Sorbent tube, quartz wool–Tenax TA, inert-coated stainless steel, 3½″ × ¼″ o.d., conditioned and capped, pk 10 *Suitable for sampling of G-type nerve agents, mustard gas (HD) and VX*	C2-CAXX-5138
Sorbent tube, HayeSep D–Tenax TA, inert-coated stainless steel, 3½″ × ¼″ o.d., conditioned and capped, pk 10 *Suitable for sampling of G-type nerve agents, mustard gas (HD), VX and the G-analogue of VX*	C2-CAXX-5250
Cold trap, 'Chemical warfare agents' *Compatible with the simultaneous analysis of all the above-mentioned analytes*	U-T10CW-2S



To order any of Markes' kits, simply telephone or send an email.

Environmental monitoring applications

Markes International offers four starter kits for a range of tube- and canister-based environmental monitoring scenarios.

Description	Part number
Basic environmental starter kit	C-KITEV01-2S
Diffusive monitoring starter kit	C-KITEV02-2S
TO-15 starter kit	C-KITEV03-2S
TO-17 starter kit	C-KITEV04-2S

The **Basic environmental starter kit** is suitable for pumped-tube sampling. It contains:

Sorbent tube, 'Universal', stainless steel, conditioned and capped, pk 10 *Suitable for pumped sampling of VOCs from $C_{2/3}$ to C_{30}*	C2-AAXX-5266
Cold trap, 'Air toxics' *Compatible with the simultaneous analysis of analytes from $C_{2/3}$ to $C_{30/32}$*	U-T15ATA-2S
Easy-VOC pump, including CapLok tool and carry-case	C-EZVOCPO

The **Diffusive monitoring starter kit** is perfect for TD users new to diffusive (passive) air sampling. It contains:

Sorbent tube, Tenax TA, stainless steel, conditioned and capped, pk 10 *Suitable for diffusive sampling of VOCs from C_6 to C_{30}*	C1-AAXX-5003
Sorbent tube, Carbograph 1TD, stainless steel, conditioned and capped, pk 10 *Suitable for diffusive sampling of VOCs from C_6 to C_{14}*	C1-AAXX-5009
Diffusion cap, aluminium, **2 ×** pk 10	**2 ×** C-DF010
CapLok tool for tightening and undoing ¼″ brass storage caps	C-CPLOK
Penclip, **2 ×** pk 10	**2 ×** C-CL010
Cold trap, 'Air toxics' *Compatible with the simultaneous analysis of analytes from $C_{2/3}$ to $C_{30/32}$*	U-T15ATA-2S

The **TO-15 starter kit**[1] is ideal for analysts setting up canister-based sampling compliant with US EPA Method TO-15. The kit contains:

Cold trap, 'Air toxics' *Compatible with the simultaneous analysis of analytes from $C_{2/3}$ to $C_{30/32}$*	U-T15ATA-2S
5 × TO-Can, 1 L, with gauge and ¼″ valve	**5 ×** C-TOCAN1
2 × Canister air sampling kit, stainless steel	**2 ×** C-ASK1168SS
Frit, stainless steel, for critical orifice, pk 3	C-ASK2USS

The **TO-17 starter kit** is perfect for monitoring 'air toxics' using pumped tubes in compliance with US EPA Method TO-17. The kit contains:

Sorbent tube, 'Air toxics', glass, conditioned and capped, pk 10 *Suitable for pumped sampling of VOCs from C_2 to C_{14}*	C2-BAXX-5259
Sorbent tube, 'Universal', stainless steel, conditioned and capped, pk 10 *Suitable for pumped sampling of VOCs from $C_{2/3}$ to C_{30}*	C3-AAXX-5266
CapLok tool for tightening and undoing ¼″ brass storage caps	C-CPLOK
Cold trap, 'Air toxics' *Compatible with the simultaneous analysis of analytes from $C_{2/3}$ to $C_{30/32}$*	U-T15ATA-2S
Certified reference standard, 9-component TO-17 mix, 100 ng, pk 10 (plus certificate, chromatogram and shipping blank)	C-TO17100-10

1. Please note that this kit is only available in certain countries – contact Markes International for details.

Material emissions applications

Three starter kits cover the monitoring of emissions from construction/household materials and consumer goods.

Description	Part number
Basic material emissions starter kit	C-KITME01-2S
Comprehensive material emissions starter kit	C-KITME02-2S
Direct desorption starter kit	C-KITDD-2S

The **Basic material emissions starter kit** is ideal for those carrying out routine in-house tests of product emissions in compliance with ISO 16000, ISO 12219 or equivalent ASTM standards. It contains:

Sorbent tube, Tenax TA, inert-coated stainless steel, conditioned and capped, pk 10 *Suitable for sampling VOCs from C_6 to C_{30}*	C1-CAXX-5003
Sorbent tube, 'Material emissions', stainless steel, conditioned and capped, pk 10 *Suitable for sampling VOCs from C_4 to C_{40}*	C3-AAXX-5304
CapLok tool for tightening and undoing ¼" brass storage caps	C-CPLOK
Cold trap, 'Material emissions' *Compatible with the simultaneous analysis of analytes from C_4 to C_{32}*	U-T12ME-2S
Quick-seal column connector, pk 10	C-QSC10

For examples of Markes' technology being used in real-world situations, download our Application Guides from www.markes.com.

The **Comprehensive material emissions starter kit** provides a wider range of parts ideal for high-throughput service or manufacturing laboratories carrying out product emissions testing using standard reference or screening methods. It contains:

Sorbent tube, Tenax TA, inert-coated stainless steel, conditioned and capped, pk 10 *Suitable for sampling VOCs from C_6 to C_{30}*	C1-CAXX-5003
Sorbent tube, 'Material emissions', stainless steel, conditioned and capped, pk 10 *Suitable for sampling VOCs from C_4 to C_{40}*	C3-AAXX-5304
Stainless steel tube, empty, pk 10 *Suitable for direct desorption*	C0-AXXX-0000
Liner[1], PTFE, snug-fit, pk 10	C-PI010
Liner[1], PTFE, loose-fit, pk 10	C-PL010
Glass tube, empty, restricted, pk 10 *Suitable for direct desorption*	C0-NXXX-0000
CapLok tool for tightening and undoing ¼" brass storage caps	C-CPLOK
Spring, torsion, for 4 mm i.d. glass tubes, pk 10	C-GTSP10
Quartz wool, 10 g	C-QUTZW
Ferrule, PTFE, one-piece, pk 20	C-FP020
Check-standard (material emissions), 100 ng, Tenax TA, pk 10	C-CHK10-ME
Cold trap, material emissions *Compatible with the simultaneous analysis of analytes from from C_4 to C_{32}*	U-T12ME-2S
Quick-seal column connector, pk 10	C-QSC10

The **Direct desorption starter kit** is a cost-effective pack of consumables for measuring chemical content or emissions from small samples of materials, according to VDA 278 or equivalent methods. It contains:

Glass tube, empty, restricted, pk 10 *Suitable for direct desorption*	C0-NXXX-0000
Cold trap, General-purpose hydrophobic, UNITY 2/UNITY-xr/TD-100/TD100-xr *Compatible with the simultaneous analysis of analytes from C_4 to C_{32}*	U-T2GPH-2S
Quartz wool, 10 g	C-QUTZW
Spring, torsion, for 4 mm i.d. glass tubes, pk 10	C-GTSP10
Calibration Solution Loading Rig	C-CSLR
Sorbent tube, Tenax TA, stainless steel, conditioned and capped, **2 ×** pk 10 *Suitable for sampling VOCs from C_6 to C_{30}*	**2 ×** C1-AAXX-5003
CapLok tool for tightening and undoing ¼" brass storage caps	C-CPLOK

1. Liners are suitable for stainless steel tubes only.

Product-specific starter kits

Markes International offers a range of product-specific kits as a cost-effective way of getting started with your application.

Description	Part number
TubeTAG starter kit (for stainless steel tubes)	C-TAGKT
Easy-VOC starter kit	C-EZVOCKT
HiSorb starter kit	C-HSPKIT
SPE-tD starter kit	C-KITSP-2S
Starter kit for Micro-Chamber/Thermal Extractor, 6-chamber, inert	M-STUKTI
Starter kit for Micro-Chamber/Thermal Extractor, 4-chamber, inert	M-STUKT250I
Automated TD starter kit, for 3½″ tubes	U-ULKIT
Automated TD starter kit, for 4½″ tubes	U-ULKIT-XZ

The **TubeTAG starter kit** for stainless steel tubes comes with a convenient carry-case, and contains:

TAG*SCRIBE* read/write device for all TubeTAGs	C-SCRIBE
TubeTAG for stainless steel tubes, pk 10	C-TAG10
TubeTAG fixing/removal tool for ¼″ stainless steel tubes	C-TAGTL
Cap, brass, ¼″ & PTFE ferrule (one standard, one tag-ready), pk 10 pairs, for ¼″ metal tubes	C-TCFP10
TAGLok tool for tightening/removing standard and TAG-ready ¼″ storage caps	C-TAGLOK

The **HiSorb starter kit**, for sorptive extraction of volatiles from liquids and solids, contains:

HiSorb-P1 probe assembly, stainless steel, standard length, pk 5	H1-XXAAC-5
Vial, 20 mL, crimp-top, glass, round-bottomed, pk 100	C-HSVC20-100
HiSorb-P1 cap & septum, for 10/20 mL crimp vial, **2 ×** pk 50	**2 ×** C-HSCSC-20C-50
HiSorb-P1 extraction device	VC-HSPH
HiSorb-P1, vial sealing plug, pk 5	C-HSVLP-5

The **SPE-tD starter kit**, for sorptive extraction of volatiles from liquids, contains:

SPE-tD cartridge (30 mm length), pk 5	C-SPTD5
Glass tube, empty, restricted, pk 10	C0-BXXX-0000
Spring, torsion, for 4 mm i.d. glass tubes, pk 10	C-GTSP10
Quartz wool (10 g)	C-QUTZW
Cold trap, Tenax TA, UNITY 2/UNITY-xr/ TD-100/TD100-xr	U-T9TNX-2S
Cap, storage, brass, ¼″ & PTFE ferrule, pk 20	C-CF020

The **starter kit for the 6-chamber Micro-Chamber/ Thermal Extractor** (max. 120°C) contains:

Sample pan, inert-coated, pk 6	M-MCHSI
Detachable sample lid, inert-coated, pk 6	M-MCTOPI
Tube interface cap, pk 6	M-TICAP
M4 flanged nut for removable lids, pk 6	SERZ-NM4FLGSS
Nut driver tool (for releasing lids)	SERZ-0669
Adjustable sprung spacer, pk 6	M-SPGSC-120
Aluminium collar spacer (15 mm), pk 6	M-SPC15-120
Aluminium collar spacer (5 mm), pk 6	M-SPC05-120
Aluminium spacer disc (1.5 mm), pk 24	M-DSK15-120
Routine maintenance kit (selection of O-rings)	RMK-0006
Sorbent tube, Tenax TA, inert-coated stainless steel, conditioned and capped, **2 ×** pk 10 *Suitable for sampling VOCs from C_6 to C_{30}*	**2 ×** C1-CAXX-5003
CapLok tool	C-CPLOK

The **starter kit for the 4-chamber Micro-Chamber/ Thermal Extractor** (max. 250°C) contains:

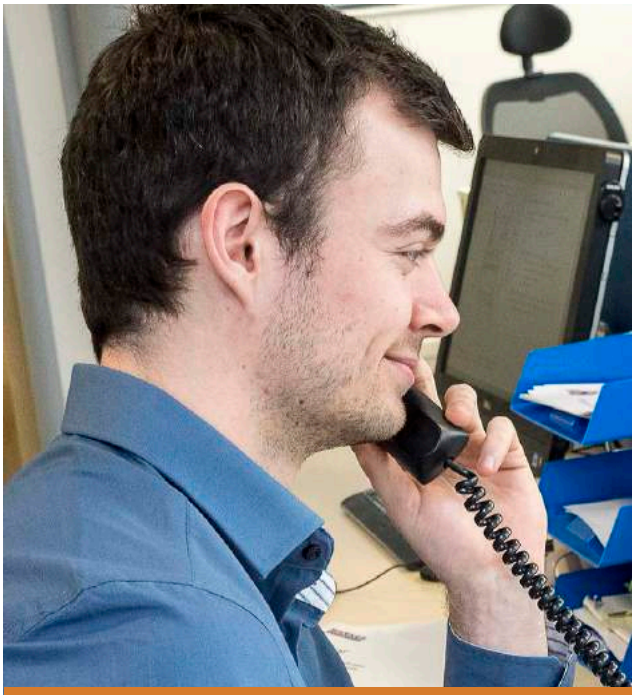
Sample pan, inert-coated, pk 4	M-MCHSS250I
Detachable sample lid, inert-coated, pk 4	M-MCTOP250I
Tube interface cap, pk 6	M-TICAP
M3 hexagonal ball driver (spanner)	SERZ-0861
Adjustable sprung spacer assembly, pk 4	M-SPGSC-250
Aluminium collar spacer (15 mm), **2 ×** pk 4	**2 ×** M-SPC15-250
Aluminium collar spacer (5 mm), **3 ×** pk 4	**3 ×** M-SPC05-250
Aluminium spacer disk (1.5 mm), pk 24	M-DSK15-250
Liquid sample insert, pk 4	M-TSTIN
Routine maintenance kit (selection of O-rings)	RMK-0006HT
Sorbent tube, Tenax TA, inert-coated stainless steel, conditioned and capped, pk 10 *Suitable for sampling VOCs from C_6 to C_{30}*	C1-CAXX-5003
CapLok tool	C-CPLOK

The **Automated TD starter kit** for the ULTRA-xr autosampler and TD100-xr, compatible with 3½″ (standard) tubes, contains:

Cap, DiffLok, stainless steel, ¼″, pk 160 *Sufficient for 80 tubes, for routine analysis*	C-DL160
O-Ring, size 007, pk 10 *For ULTRA 2 /ULTRA-xr tube receiver*	U-COV07
O-Ring, size 010, pk 10 *For tube interface seal*	U-COV10

The **Automated TD starter kit**, for the model of the ULTRA autosampler compatible with 4½″ tubes with 6 mm o.d. ends, contains:

Cap, DiffLok, pk 80 pairs (80 stainless steel, 80 inert-coated) *Sufficient for 80 tubes, for routine analysis*	C-DLP80-XZ
O-Ring, size 007, pk 10 *For ULTRA 2/ULTRA-xr tube receiver*	U-COV07
O-Ring, 5.92 mm i.d., pk 10 *For tube interface seal*	U-COV45



To order any of Markes' kits, simply telephone or send an email.

Instrument spares

Spares and accessories for all Markes International's TD systems

Product highlights

- Single source for all Markes' instrument spares
- Genuine high-quality Markes spares
- Routine maintenance kits to ensure ongoing high performance

Contact Markes International for expert advice

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Germany: +49 (0)6102 8825569

TD-100™ and TD100-xr™

Cryogen-free automated thermal desorbers

User-installable spares for all TD-100 and TD100-xr models.

Description	Part number
O-Ring, low-emission, size 006, pk 10	U-COV06
O-Ring, low-emission, size 007, pk 10	U-COV07
O-Ring, low-emission, size 010, pk 10	U-COV10
O-Ring, low-emission, size 010, pk 100	U-COV100
Ferrule, 1/16″ × 0.4 mm graphite/Vespel®, pk 10 *Connects fused silica transfer line*	U-FV001
ULTRA 2/ULTRA-xr/TD-100/TD100-xr O-ring insertion tool	SERMTD-1382
Fused silica transfer line insert (0.25 mm i.d.) and PTFE sleeve (1.4 m)	SERUTD-5093
Fused silica transfer line insert (0.25 mm i.d.) and PTFE sleeve (2 m)	SERUTE-5099
Split filter tube, stainless steel, 3½″, packed with charcoal	SERUTD-5065
Filter, disk, sintered PTFE, 5.1 mm section, pk 10	U-DISK1
Quick-seal column connector, pk 10 *Connects fused silica to column*	C-QSC10

UNITY™ 2 and UNITY-xr™

Cryogen-free single-tube thermal desorbers

User-installable spares for UNITY 2 and UNITY-xr models.

Description	Part number
O-Ring, low-emission, size 006, pk 10	U-COV06
O-Ring, low-emission, size 010, pk 10	U-COV10
O-Ring, low-emission, size 010, pk 100	U-COV100
O-Ring, low-emission, 5.92 mm i.d., pk 10	U-COV45
Split filter tube, stainless steel, 3½″, packed with charcoal	SERUTD-5065
Split filter tube, glass, 3½″, packed with charcoal (used for on-line systems)	SERAAA-1600
Split filter tube, glass, 4½″, packed with charcoal	SERAAA-5167
Fused silica transfer line insert (0.25 mm i.d.) and PTFE sleeve (1.4 m)	SERUTD-5093
Fused silica transfer line insert (0.25 mm i.d.) and PTFE sleeve (2 m)	SERUTE-5099
Ferrule, 1/16″ × 0.4 mm graphite/Vespel®, pk 10 *Connects fused silica transfer line*	U-FV001
Filter, disk, sintered PTFE, 5.1 mm section, pk 10	U-DISK1
Quick-seal column connector, pk 10 *Connects fused silica to column*	C-QSC10
UNITY 2 software CD (includes automation)	U-SW001-2S
UNITY 2 tube oven conversion kit, 3½″ to 4½″	U-35TO45KT
UNITY 2 tube oven conversion kit, 4½″ to 3½″	U-45TO35KT

ULTRA™ 2 and ULTRA-xr™

Autosamplers for UNITY thermal desorbers

User-installable spares for ULTRA 2 and ULTRA-xr models.

Description	Part number
Cap, DiffLok, stainless steel, ¼″, pk 10	C-DL010
Cap, DiffLok, stainless steel, ¼″, pk 100	C-DL100
Cap, DiffLok, inert, ¼″, pk 10	C-DLS10
Cap, DiffLok, inert, ¼″, pk 100	C-DL1S0
Cap, DiffLok, one stainless steel, one inert-coated, ¼″, pk 10 pairs	C-DLP10
Cap, DiffLok, one stainless steel, one inert-coated, ¼″, pk 100 pairs	C-DL1P0
Cap, DiffLok, stainless steel, 6 mm, pk 10	C-DL010-XZ
Cap, DiffLok, stainless steel, 6 mm, pk 100	C-DL100-XZ
Cap, DiffLok, inert, 6 mm, pk 10	C-DLS10-XZ
Cap, DiffLok, inert, 6 mm, pk 100	C-DL1S0-XZ
Cap, DiffLok, one stainless steel, one inert-coated, 6 mm, pk 10 pairs	C-DLP10-XZ
Cap, DiffLok, one stainless steel, one inert-coated, 6 mm, pk 100 pairs	C-DL1P0-XZ
O-Ring, low-emission, size 010, pk 10 (for ¼″ DiffLok caps)	U-COV10
O-Ring, low-emission, size 010, pk 100 (for ¼″ DiffLok caps)	U-COV100
O-Ring, low-emission, 5.92 mm i.d., pk 10 (for 6 mm DiffLok caps)	U-COV45
O-Ring, low-emission, size 007, pk 10 (ULTRA 2/ULTRA-xr tube receiver)	U-COV07
Label, ULTRA 2/ULTRA-xr tray, 4½″, strip of 10, blue	SERMTD-1394BU
ULTRA 2/ULTRA-xr/TD-100/TD100-xr U-COV07 O-ring insertion tool	SERMTD-1382
TubeTAG read/write option for ULTRA 2/ ULTRA-xr	U-TAGRW-2S

For more information on any of Markes International's products, download the brochures from www.markes.com.

Air Server™ 2 and Air Server-xr™

UNITY accessories for on-line air monitoring and canister analysis

User-installable spares for all Air Server and Air Server-xr models.

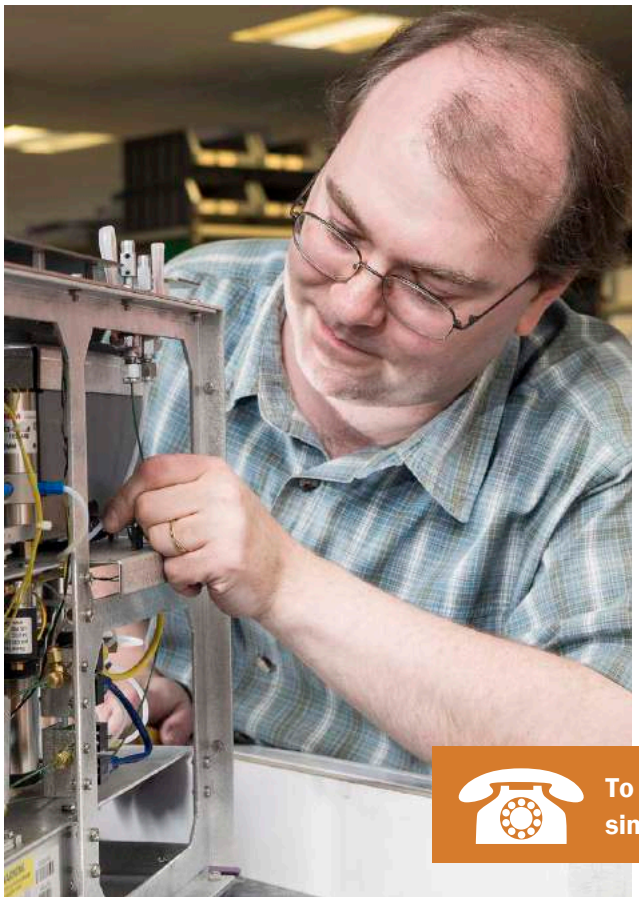
Description	Part number
Split filter tube, glass, 3½″, packed with charcoal	SERAAA-1600
Tubing, PTFE, 1/8″, 1 m	SERZ-0062
Sample transfer line (ASIS 8 only)	SERASU-5041
Pump, 100 V, for unpressurised samples	U-ASPM3
Pump, 115 V, for unpressurised samples	U-ASPM1
Pump, 230 V, for unpressurised samples	U-ASPM2
Filter, disk, sintered PTFE, 3.2 mm section, pk 10	U-DISK4
Dryer kit for Air Server 2/Air Server-xr	U-ASDRY
Connection kit, to connect Air Server 2/Air Server-xr and ULTRA 2/ULTRA-xr to the same UNITY 2/UNITY-xr, 3½″	U-UASK2-2S
Connection kit, to connect Air Server 2/Air Server-xr and ULTRA 2/ULTRA-xr to the same UNITY 2/UNITY-xr, 4½″	U-UASK2-XZ

CIA *Advantage*™

Cryogen-free autosampler for analysing air in canisters or bags

User-installable spares for all CIA *Advantage* models.

Description	Part number
Dryer kit for CIA *Advantage*	U-ASDRY
Humidifier, for humidification of purge gas	U-HUMID
Heated sample line (1.8 m length) for CIA *Advantage*-HL and CIA *Advantage* Satellite, pk 14	U-HTLNKT
Heated sample line (1.8 m length) for CIA *Advantage*-T, pk 14	U-HTLNKT-T
Filter, disk, sintered PTFE, 3.2 mm section, pk 10	U-DISK4
Pump, 100 V, for unpressurised samples	U-ASPM3
Pump, 115 V, for unpressurised samples	U-ASPM1
Pump, 230 V, for unpressurised samples	U-ASPM2
Split filter tube, glass, 3½″, packed with charcoal	SERAAA-1600
Sample loop, 0.1 mL	SERZ-0993
Sample loop, 0.5 mL	SERZ-0994
Sample loop, 1 mL	SERZ-0516
Sample loop, 2 mL	SERZ-0995



To order any of Markes International's instrument spares, simply telephone or send an email.

TT24-7™

Twin-trap thermal desorption system for continuous near-real-time monitoring

TT24-7 Series 1

In June 2013, TT24-7 Series 1 was discontinued. However, user-installable spares are still available from Markes International, as listed below.

Description	Part number
O-Ring, low-emission, size 006, pk 10	U-COV06
O-Ring, low-emission, size 007, pk 10	U-COV07
O-Ring, low-emission, size 010, pk 10	U-COV10
O-Ring, low-emission, 3.9 mm i.d., pk 10	U-COV39
Filter, disk, sintered PTFE, 5.1 mm section, pk 10	U-DISK1
Filter, disk, sintered PTFE, 6.5 mm section, pk 10	U-DISK3
Fused silica transfer line insert (0.25 mm i.d.) and PTFE sleeve	SERUTD-5093
Split filter tube, stainless steel, 3½″, packed with charcoal	SERUTD-5065
Ferrule, 1/16″ × 0.4 mm graphite/Vespel®, pk 10 *Connects fused silica transfer line*	U-FV001
Pump, 100 V, for unpressurised samples	U-ASPM3
Pump, 115 V, for unpressurised samples	U-ASPM1
Pump, 230 V, for unpressurised samples	U-ASPM2
Dual regulator pneumatics accessory *For dry gas and carrier gas regulation*	U-GAS01

To order any of Markes International's instrument spares, simply telephone or send an email.

TT24-7 Series 2

Description	Part number
O-Ring, low-emission, size 007, pk 10	U-COV07
O-Ring, low-emission, size 010, pk 10	U-COV10
Filter, disk, sintered PTFE, 5.1 mm section, pk 10	U-DISK1
Filter, carbon, TT24-7 Series 2 air inlet	U-FLTRTT-C
Cup mesh for cold trap link, 6 mm	SERAAA-1603
Gauze filter, ¼″, inert, sample inlet, TT24-7	SERTTD-1150
Fused silica transfer line insert (0.25 mm i.d.) and PTFE sleeve	SERUTD-5093
Split filter tube, stainless steel, 3½″, packed with charcoal	SERUTD-5065
Split filter tube, glass, 4½″, packed with charcoal	SERAAA-5167
Ferrule, 1/16″ × 0.4 mm graphite/Vespel®, pk 10 *Connects fused silica transfer line*	U-FV001
Quick-seal column connector, pk 10	C-QSC10
Dryer kit for Air Server 2/Air Server-xr and CIA systems	U-ASDRY
Heated sample line, inert, 2 m	U-HSLTT
UNITY 2/UNITY-xr tube oven conversion kit, 3½″ to 4½″ *User-installable*	U-35TO45KT
Pump, 100 V, for unpressurised samples	U-ASPM3
Pump, 115 V, for unpressurised samples	U-ASPM1
Pump, 230 V, for unpressurised samples	U-ASPM2
Dual regulator pneumatics accessory *For dry gas and carrier gas regulation*	U-GAS01

For more information on any of Markes International's products, download the brochures from www.markes.com.

Routine maintenance kits

Routine maintenance kits contain sufficient spares (O-rings, PTFE filters, *etc.*) for approximately 12 months' use. Where indicated, the relevant cold trap is included.

Description	Part number
Routine maintenance kit, UNITY 2/UNITY-xr, 3½″, specify cold trap	RMK-0001-2S
Routine maintenance kit, UNITY 2/UNITY-xr, 3½″, without cold trap	RMK-0004-2S
Routine maintenance kit (ECC), UNITY 2/ UNITY-xr, 3½″, with U-T11GPC-2S cold trap	RMK-012-2S
Routine maintenance kit, UNITY 2/UNITY-xr, 4½″, specify cold trap	RMK-0001-XZ
Routine maintenance kit, UNITY 2/UNITY-xr, 4½″, without cold trap	RMK-0004-XZ
Routine maintenance kit, TD-100/TD100-xr, specify cold trap	RMK-0009
Routine maintenance kit, TD-100/TD100-xr, without cold trap	RMK-0010
Routine maintenance kit for TT24-7, without cold traps	RMK-0005
Routine maintenance kit, 3½″, Air Server 2/ Air Server-xr/CIA systems	RMK-0003-2S

Suggested maintenance schedules

Suggested maintenance frequencies are given below. However, in some cases (depending on the application), items may need replacing more often.

TD-100 and TD100-xr

Condition/change charcoal filter (split tube)	3 months[1]
Replace cold trap	12 months[1]
Replace fused silica transfer line	12 months
Change sample tube O-rings/ filters	12 months, or if damaged/ leaking
Cold trap seals	12 months, or if damaged/ leaking
Replace O-rings in DiffLok caps	If damaged/leaking
Change nozzle seals	If damaged/leaking

UNITY 2 and UNITY-xr

Condition/change charcoal filter (split tube)	3 months[1]
Replace/repack cold trap	12 months[1]
Replace fused silica transfer line	12 months
Change sample tube O-rings/ filters	12 months, or if damaged/ leaking
Cold trap seals	12 months, or if damaged/ leaking

ULTRA 2 and ULTRA-xr

Replace O-rings in DiffLok caps	If damaged/leaking
Change nozzle seals	If damaged/leaking

Air Server 2, Air Server-xr and CIA *Advantage*

Replace filter disks	12 months

As well as routine maintenance procedures carried out by the user, Markes International's specialists strongly recommend that a routine maintenance service is carried out on your TD system, by a trained service engineer, at least once a year.

1. Note that these parts may require changing more frequently in automated systems.

Email: enquiries@markes.com **Web:** www.markes.com

Laboratory accessories

A comprehensive range of accessories for your laboratory

Product highlights

- Pneumatic control accessories specifically for Markes International's instruments
- Leak detectors, flowmeters and gas purifiers for quality assurance of gas flows
- Range of precision syringes for gas and liquid injections
- Consumables for capillary columns

Contact Markes International for expert advice

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Pneumatic control accessories

Dual regulator pneumatics accessory

Markes International's high-quality dual regulator pneumatics accessory controls both carrier gas and dry gas flows, and is strongly recommended for all Markes' thermal desorbers.

It consists of a stainless steel regulator (0–60 psig) for control of the carrier gas, and a standard regulator (0–100 psig) for control of the dry gas. Both lines also have on/off toggle valves.

Description	Part number
Dual regulator pneumatics accessory *For dry gas and carrier gas regulation*	U-GAS01

Single regulator pneumatics accessory

The single regulator pneumatics accessory is recommended for:

- Controlling the purge gas supply on ULTRA-xr and TD100-xr autosamplers with internal standard functionality.
- Regulating the pressure of internal standard (IS) gas if no other appropriate regulation is supplied.
- Controlling the supply gas to the Micro-Chamber/ Thermal Extractor, TC-20 and Calibration Standard Loading Rig.

It consists of a high-quality (stainless steel) regulator (0–60 psig) and an on/off toggle valve.

Description	Part number
Single regulator pneumatics accessory *For carrier gas regulation*	U-GAS03

Helium leak detector

This portable, highly sensitive helium leak detector for TD–GC systems provides the accurate, sensitive and rapid detection of carrier gas leaks that is essential for TD–GC troubleshooting.

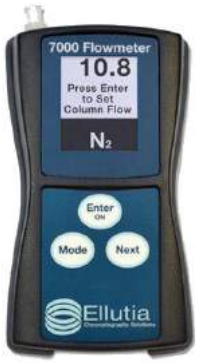
Gas leaks are clearly indicated on the LED display, and it is powered by rechargeable batteries for ease of portability.

Full specifications for the helium leak detector can be found on Markes International's website.

Description	Part number
Helium leak detector including 230 V charger	C-HEL23
Helium leak detector including 115 V charger	C-HEL11

Flowmeter

With resolution of 0.1 mL/min, and accuracy typically better than ±2.5%, this solid-state digital flowmeter offers outstanding performance for measuring TD gas.



It is compatible with eight gases: air, argon, argon–5% methane, carbon dioxide, helium, hydrogen, nitrogen and oxygen, in the range 0.1–500 mL/min.

Calibration is traceable to the UK National Physical Laboratory (NPL) standards, and an annual recalibration service (for helium, air and nitrogen) is offered on a return-to-factory basis.

Full specifications for the flowmeter can be found on Markes International's website.

Description	Part number
Digital flowmeter	C-FLMTR
Recalibration service for digital flowmeter (return to Markes)	C-FLCAL

Email: enquiries@markes.com **Web:** www.markes.com

Gas purifiers

Markes International's specialists strongly recommend these carrier gas purifiers to avoid contamination of the analytical system with hydrocarbons, oxygen or water. General-purpose purifiers are available for standard TD–GC operation, as well as high-capacity purifiers for specialised applications.

Hydrocarbon trap

The hydrocarbon trap is ideal for the removal of C_{3+} hydrocarbons in helium, hydrogen, nitrogen, argon–methane and air. Refill kits are also available. The trap has a maximum flow capacity of 2 L/min and the stated life is 16 cylinders.[1]

Water vapour trap

This molecular sieve trap efficiently removes water from helium, hydrogen, nitrogen, air, *etc.* The trap has a maximum flow capacity of 2 L/min and the stated life is 68 cylinders.[1]

Oxygen/water trap

This trap reduces O_2 levels to less than 2 ppb.[2] It can extract contaminating oxygen at 10 ppm from at least three 8.5 m^3 cylinders, and the maximum flow capacity is 250 mL/min.

Helium purifier

This purifier removes O_2, H_2O, hydrocarbons, CO_2 and CO from helium, giving an output gas that is 99.99999% pure. The maximum flow capacity is 8 L/min, and the stated life is 13 standard cylinders[2] of 99.999% helium.

High-capacity gas purifier

This specialised gas purifier removes both O_2 and H_2O from any common carrier gas (except hydrogen) by a catalytic reaction. It can purify up to 60 tanks of heavily contaminated gas containing 100 ppm O_2 and/or H_2O at flow rates of up to 1.1 L/min. A pressure gauge should be fitted at the outlet to monitor the pressure drop across the purifier – when the drop exceeds 10 psi the purifier tube should be replaced.

1. Based on standard 218 ft^3 cylinder containing 50 ppm contaminants.
2. When the level in the incoming gas does not exceed 10 ppm.

Description	Part number
Gas purifier, hydrocarbon trap, 120 cc, ⅛″ fittings	C-HCTRP
Gas purifier, hydrocarbon trap, refill material	C-RFHCT
Gas purifier, water vapour trap, 200 cc, ⅛″ fittings	C-MSTRP
Gas purifier, water vapour trap, refill material	C-RFMST
Gas purifier, oxygen/water trap, 120 cc, ⅛″ fittings	C-O2TRP
Gas purifier, helium purifier, ⅛″ fittings	C-HEPUR
Gas purifier, high-capacity, 230 V, ⅛″ fittings	C-HCP23
Gas purifier, high-capacity, 110 V, ⅛″ fittings	C-HCP11
Gas purifier, high-capacity, replacement purifier tube, ⅛″ fittings	C-HCPTB
Gas purifier, high-capacity, replacement element, 230 V	C-HCE23
Gas purifier, high-capacity, replacement element, 110 V	C-HCE11
Gas purifier, high-capacity, outlet pressure gauge	C-HCPPG

To order any of Markes International's laboratory accessories, simply telephone or send an email.

Syringes

Markes International offers two precision syringes for liquid injections.

The **1 µL plunger-in-needle liquid syringe** fitted with a repeating adaptor provides ±2% accuracy and reproducibility for injection volumes down to 0.1 µL.

The **5 µL plunger-in-barrel liquid syringe** provides ±1% accuracy and reproducibility for injection volumes between 1 and 5 µL.

Description	Part number
Syringe, 1 µL, plunger-in-needle with repeating adaptor, 50 mm needle length, 0.63 mm needle o.d.	C-SYL00-1UL
Syringe, 1 µL, replacement needle and plunger repair kit	C-SYLRP-1UL
Syringe, 5 µL, plunger-in-barrel fixed needle, 50 mm needle length, 0.47 mm needle o.d.	C-SYL00-5UL

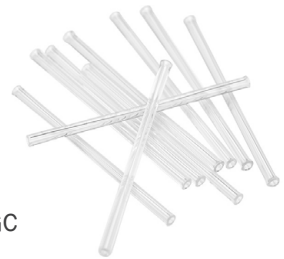
Capillary column cutting tool

Used to cut the ends of fused silica tubing (*e.g.* transfer line insert or capillary columns) to ensure burr-free square ends, and reliable capillary–capillary connections.

Description	Part number
Fused silica column-cutting tool	C-FSCCT

To order any of Markes International's laboratory accessories, simply telephone or send an email.

Fused silica column connectors



Single-use quick-seal **capillary column connectors** are supplied with every Markes International TD system, and are used to connect the fused silica transfer line insert to the GC capillary column inside the GC oven. They are suitable for most routine applications.

Reusable nut-and-ferrule **SilTite™ mini-unions** are recommended to make capillary–capillary connections for TD–GC systems incorporating an MS detector.

Description	Part number
Quick-seal column connector, pk 10	C-QSC10
SilTite mini-union, connects 0.25 mm fused silica transfer line to capillary column (up to 0.25 mm i.d.)	C-MU000
Ferrule, SilTite mini-union, 0.1–0.25 mm i.d. (columns up to 0.25 mm i.d.), pk 10	C-MUF25
Ferrule, SilTite mini-union, 0.32 mm i.d. (0.32 mm i.d. columns), pk 10	C-MUF32

Copper tubing and unions

This solvent-washed refrigeration-grade ⅛″ copper tubing should be used to supply gases to TD–GC systems. It should not be brazed, and should only be connected using GC-compatible Swage-type unions.

Description	Part number
Copper tubing, 3 m	C-CUTUB-3M
Union, brass, ⅛″, T-shaped	SERZ-0104
Union, brass, ⅛″–⅛″	SERZ-0026

MARKES international

Sorbents

Bulk sorbents from Markes – opening up a range of tube packing options

Product highlights

- Bulk sorbents for tube packing
- Popular Tenax® sorbents for routine applications
- Graphitised carbon blacks for trace-level applications
- Carbonised molecular sieves for highly volatile compounds
- Quartz and glass wools for very high-boiling and highly reactive compounds

Contact Markes International for expert advice

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Germany: +49 (0)6102 8825569

Porous polymers

Most porous polymer sorbents are inert, making them suitable for the analysis of labile and reactive compounds such as thiols and CS gas. In addition, their broadly hydrophobic nature allows them to be used for sampling in humid conditions.

Description	Part number
Sorbent, Tenax® TA (35/60), 10 g	C-TNXTA
Sorbent, Tenax TA (60/80), 10 g	C-TNXTA60
Sorbent, Tenax GR (35/60), 10 g	C-TNXGR
Sorbent, Tenax GR (60/80), 10 g	C-TNXGR60
Sorbent, PoraPak™ N (50/80), 20 g	C-2PPKN
Sorbent, PoraPak Q (50/80), 20 g	C-2PPKQ
Sorbent, HayeSep® D (60/80), 20 g	C-2HSPD

Graphitised carbon blacks

These are non-specific carbon sorbents, widely used for trace-level applications due to their minimal artefact levels. They vary from very weak to medium/strong, and are used for a wide range of VOCs and SVOCs.

Description	Part number
Sorbent, Carbograph™ 2TD (20/40), 10 g	C-CG220
Sorbent, Carbograph 2TD (40/60), 10 g	C-CG240
Sorbent, Carbograph 2TD (60/80), 10 g	C-CG260
Sorbent, Carbograph 1TD (20/40), 10 g	C-CG120
Sorbent, Carbograph 1TD (40/60), 10 g	C-CG140
Sorbent, Carbograph 1TD (60/80), 10 g	C-CG160
Sorbent, Carbograph 4TD (20/40), 10 g	C-CG420
Sorbent, Carbograph 5TD (20/40), 10 g	C-CG520
Sorbent, Carbograph 5TD (40/60), 10 g	C-CG540

For more information on particular sorbent characteristics, analyte ranges and advice on successful use, download Application Note 005.

Carbonised molecular sieves

Carbonised molecular sieves are the strongest sorbents and are used to trap the most volatile compounds.

Description	Part number
Sorbent, Carboxen™ 569 (60/80), 10 g	C-C569
Sorbent, SulfiCarb™ (40/70), 10 g	C-SLCRB
Sorbent, Carbosieve™ S-III (60/80), 10 g	C-CSIII
Sorbent, Carboxen 1003 (40/60), 10 g	C-C1003
Sorbent, Carboxen 1000 (60/80), 10 g	C-C1000

Zeolite molecular sieves

These are very selective hydrophilic sorbents used for specific TD applications.

Description	Part number
Sorbent, molecular sieve 5 Å, 20 g	C-MSV5A
Sorbent, molecular sieve 13X, 20 g	C-MS13X

Confused about any aspect of sorbent selection or tube packing? Contact Markes International for expert advice.

Other sorbents

Other materials, such as quartz beads, quartz wool and glass wool, can be used in sorbent tubes and cold traps.

Description	Part number
Quartz bead, 1.5 mm, pk 100	C-QTZBD
Quartz wool, 10 g	C-QUTZW
Glass wool, silanised, 10 g	C-SILGW
Glass wool, unsilanised, 10 g	C-UNSGW
Sorbent, activated charcoal, 5 g	C-CHARC

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Get your application questions answered – call our experts or visit www.markes.com

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List of part numbers

Where a component appears as part of a kit, a letter 'K' appears after the page number.

Index

Where a component with a main entry is also mentioned elsewhere, the main entry is underlined.

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MARKES international

Markes International

Since 1997, Markes International has been at the forefront of innovation for enhancing the measurement of trace-level volatile and semi-volatile organic compounds (VOCs and SVOCs) by gas chromatography (GC).

Our range of thermal desorption products has for many years set the benchmark for quality and reliability. By lowering detection limits, and increasing the options open to the analyst, our thermal desorbers greatly extend the application range of GC.

Our comprehensive portfolio of thermal desorption products includes instruments such as UNITY-xr and TD100-xr, a wide range of high-quality sorbent tubes, and innovative accessories that allow representative vapour profiles to be collected with minimal inconvenience.

Markes is headquartered near Cardiff, UK, and also has laboratory and demonstration facilities in Cincinnati and Sacramento, USA, and near Frankfurt, Germany. Markes is a company of the Schauenburg International Group.

Markes International's facilities in the UK (top left), Germany (middle left), Cincinnati, USA (right) and Sacramento, USA (bottom).

About the Schauenburg International Group

The Schauenburg International Group is a family-owned technology business with more than 30 sites worldwide, and a focus on electronic technologies, machinery and equipment, plastics processing, and engineering products.

SCHAUENBURG
International Group

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