

Advanced in vitro exposure systems

VITROCELL VC 10[®] S-TYPE SMOKING ROBOT



Platform concept

- conventional cigarettes
- e-cigarettes
- fast cleaning

VITROCELL SMOKING ROBOT VC 10[®] S-TYPE

Features all special requirements for high-class research



VC 10[®] S-TYPE equipped for operation with e-cigarettes

Objective

Cutting edge technologies make the VITROCELL[®] smoking machine VC 10[®] S-TYPE a perfect tool for evaluation of conventional and e-cigarettes.

This smoking machine features all special requirements for high-class research: compliance with ISO, Health Canada and square puff profile protocols as well as ease of handling, fast cleaning and high

speed product change capabilities.

It is suitable for working with side- and mainstream smoke, and offers significant advantages over other smoking machines.

Generation of smoke with the shortest distance to cell cultures

For the success of an experiment with mainstream tobacco smoke it is important that the distance between the smoke

generation (cigarette holders) and the VITROCELL[®] cell exposure system is as short as possible in order to avoid aging and to guarantee a smoke composition matching the real-life situation.

Open and flexible system / incorporation of other analytical tools

The robot is designed to allow easy access to all tubes, filters and the syringe system.

Additional analytical equipment relevant to the experiment can be installed without difficulty by the operator.

Freely programmable parameters

The computer system allows highly flexible programming of the smoking process. Changing from single cigarette smoke to serial smoke mode for a defined number of cigarettes is possible.



All parameters of the smoking process like puff duration, puff volume, puff frequency and exhaust duration can be defined according to the needs of the experiment.

Statistics

The data of the smoking process are logged into an Excel® sheet for further processing.

All components are easy to clean

In particular the work with unfiltered mainstream smoke demands frequent cleaning of all parts of the robot which are in contact with the smoke.

Cleaning must take place after each experiment in order to avoid any influence of residual products on the following experiment. Due to the easy access to all parts the cleaning can be done quickly and efficiently.

Compatibility with other systems in the lab

The robot can be integrated with and connected to other lab systems, e.g. analytical or automation systems.

Compliance with ISO 3308:2012

The robot meets the requirements of ISO 3308:2012 which assures a compatibility

with data generated for quality assurance purposes on other smoking machines.

Compliance with Health Canada / CRM 81 Conditions

The robot meets the requirements of 55 ml/30 sec puff frequency for smoking combustion as well as electronic cigarettes.

Bell shaped as well as square puff profile capabilities

Human puff profiles

This optional feature offers the possibility to feed data of human puff profiles registered by Smoking Puff Analyzers to the robot controls.

Quality

The robot is built to the highest standards using reliable and durable components. Precision of the process is ensured by a stepper motor for smoking port rotation and linear drive motor for the pump as well as sensor-controlled and pneumatically-driven components. Compliance with CE standards.

Service

All VC 10® robots are designed to be very service-friendly and have a secure internet-based remote servicing module.

Special Features

- Platform concept with docking stations
- Large magazine for 300 cigarettes enabling long test runs
- New smoking head with small dead volume and integrated butt ejector
- Quick-lock holder system for all types of conventional and e-cigarettes
- Machine-controlled button actuator for e-cigarettes
- Heated smoke path system
- New multiple 5-port exhaust system
- Scalable to up to 3 syringe drives
- Entire product change cleaning in < 10 min (with a few prepared exchange parts)



VC 10® S-TYPE equipped for operation with conventional cigarettes. Due to the unique platform concept with docking stations an entire product change including cleaning can be performed in < 10 min (with a few prepared exchange parts).

Operation for e-cigarettes

Quick-lock holder system with e-cigarette support crown

The holders can be quickly exchanged for cleaning and the support crown holds heavier e-cigarettes safely.



Optional holder for e-cigarettes

Secure and tight connection of any puff-actuated device to Smoking Machine.



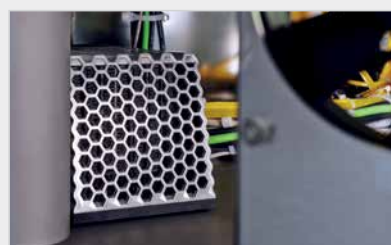
Programmable button actuator

The button actuator has a trigger function which is controlled by the VC 10® S-TYPE software.



Heated smoke path

The smoke path can be heated and temperature controlled to avoid eventual condensation.







VITROCELL® Vapestarter

Innovative solution for smoking machines: automatic button activation of e-cigarettes

Button activated e-cigarettes put the user of smoking machines into a problem: should one press the button every 30 or 60 seconds manually? The automated solution to press the button in a precise manner is the VITROCELL® Vapestarter. The device can be connected to any VITROCELL® smoking machine. The trigger function is controlled by the software of the smoke generator.

The Vapestarter device is also available with a timer function so that it can be used for other types of smoke generators.

The system consists of Vapestart Controller, e-cigarette holder and different Vapestarter units. The Vapestarter units are tailor-made

to fit tank products having different diameters as well as square shapes.



The system consists of Vapestart Controller, e-cigarette holder and different Vapestarter units.



The Vapestarter unit is available for different dimensions of tank products

Features

- Integration into software of VC 1, VC 1 S-TYPE, VC 1/7, VC 10® and VC 10® S-TYPE Smoking Machines
- Vapestarters available for all sizes of tank products
- Inclination angle from 0-90°
- Quick-change mechanism for easy exchange of test products
- Also available as standalone version
- Operation by compressed air



Operation for conventional cigarettes

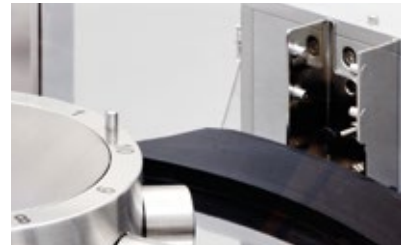
Magazine

The magazine stores up to 300 cigarettes and has a machine-controlled feeding and aligning system.



Automatic leak detector

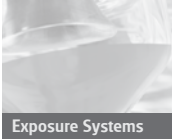
There is the option to activate the leak detector prior to each experiment. The detector confirms the tightness of the system including cigarette holders and pump. The results are logged in the study files.



Loading unit

Damage-free loading of the cigarettes into the cigarette holders takes place fully automatically. The cigarette holders are equipped with labyrinth seals as required by ISO 3308:2012.





Exposure Systems



Dose Supply



Dilution



Racks & Carts



Dose Monitoring



Skin Exposure



Auxiliary Equipment

Ignition and smoking

Lighter

The electric lighter ensures the automatic ignition and a safe procedure without cigarette damage.



Syringe drive

The syringe pump is controlled with high precision by a strong linear motor. Due to the special design, the syringe can be dismantled for cleaning and refitted again in a very short time. The machine can be scaled up to 3 syringe drives to increase the puff frequency.



Stepper motor for rotation of port holder

The rotation of the port holder is controlled by a stepper motor with highest precision.



Cambridge filter

The Cambridge filter can be mounted easily into the system for analytical purposes.



VITROCELL[®]
S Y S T E M S

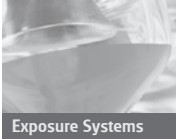
BT1.47

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3P

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3P



Exposure Systems



Dose Supply



Dilution



Racks & Carts



Dose Monitoring



Skin Exposure

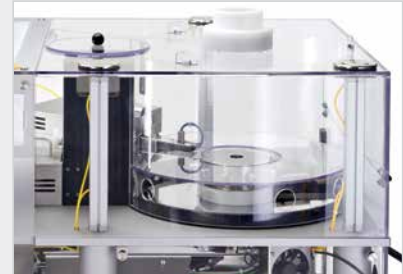


Auxiliary Equipment

Smoking and butt extraction

Hood with sidestream smoke ducts

The integrated fan evacuates the sidestream smoke. The air flow at the cigarette holders is adjusted by the fan speed.



Butt length sensor

The IR-sensor can be adjusted to a fraction of a millimeter and transmits reliable signals to the pump and butt extractor. If the critical butt length is reached, the pump stops immediately. Alternatively, it is also possible to work with a defined number of puffs.



Butt ejector

The cigarette butts are removed from the holder by ejection. The ashtray is kept permanently clean with a brush.

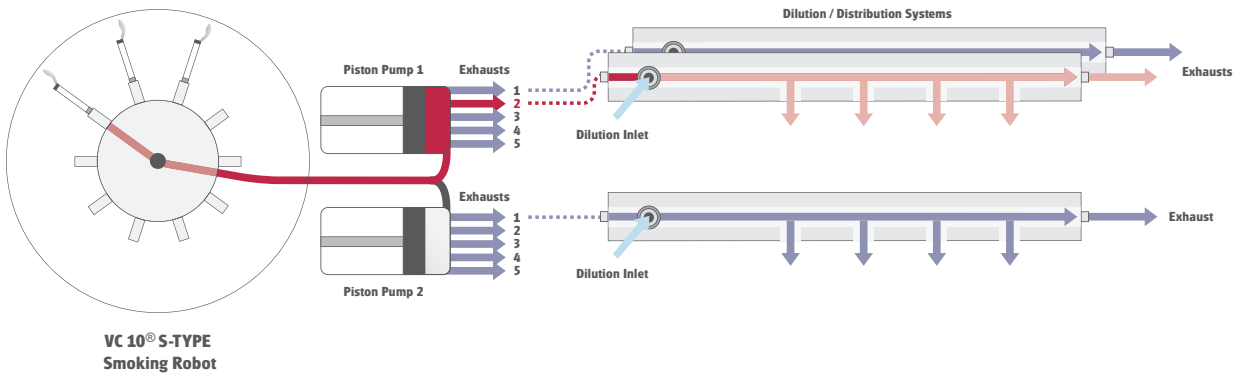
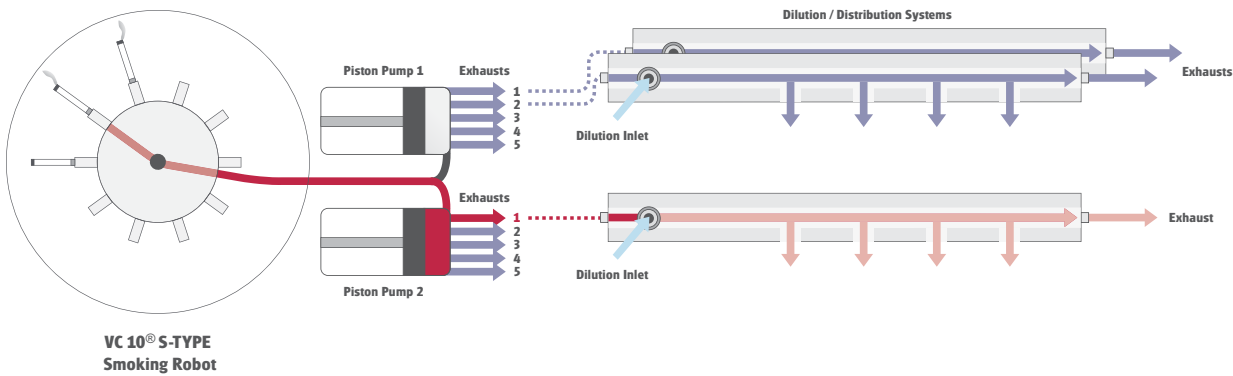
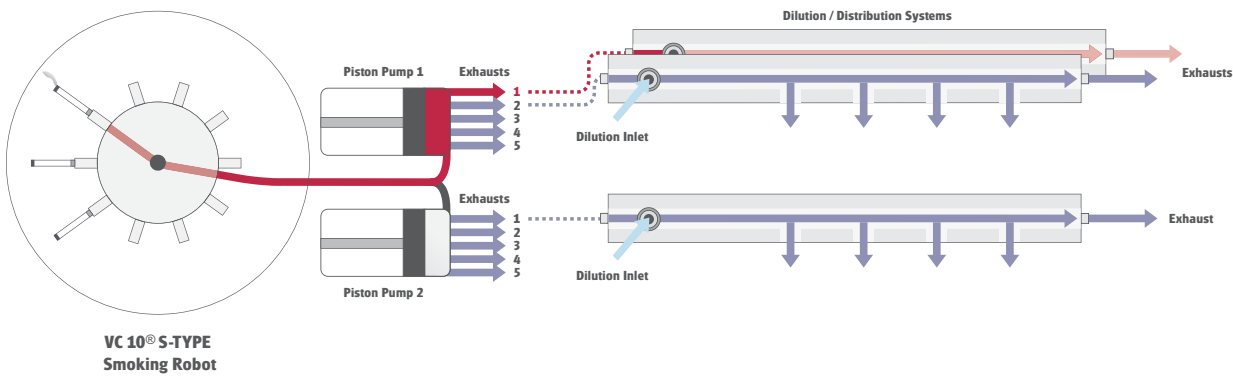


Large butt reservoir

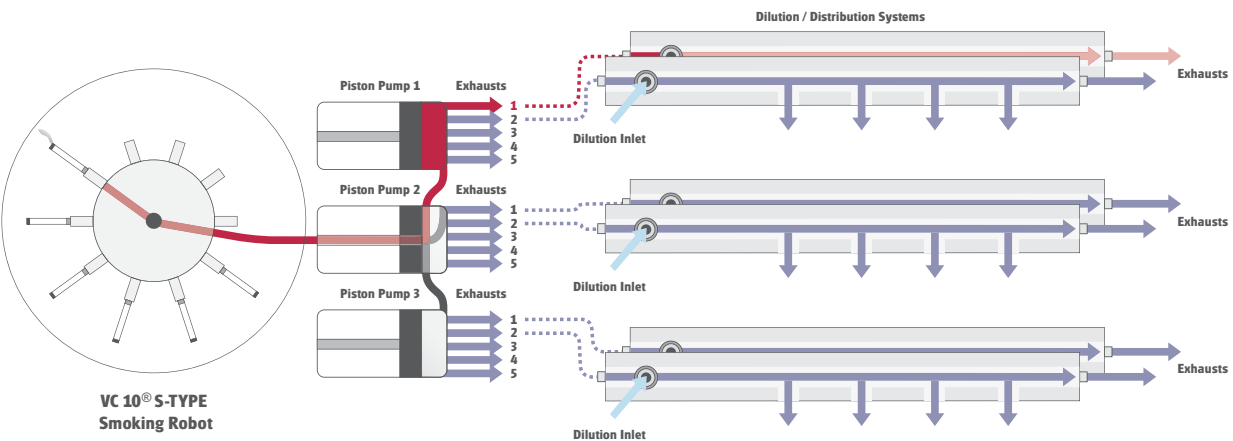
The butts are forwarded into a large reservoir.



Example of 2-piston pump operation with 3 cigarettes



Example of 3-piston pump operation with 6 cigarettes





Unique 5-port exhaust system

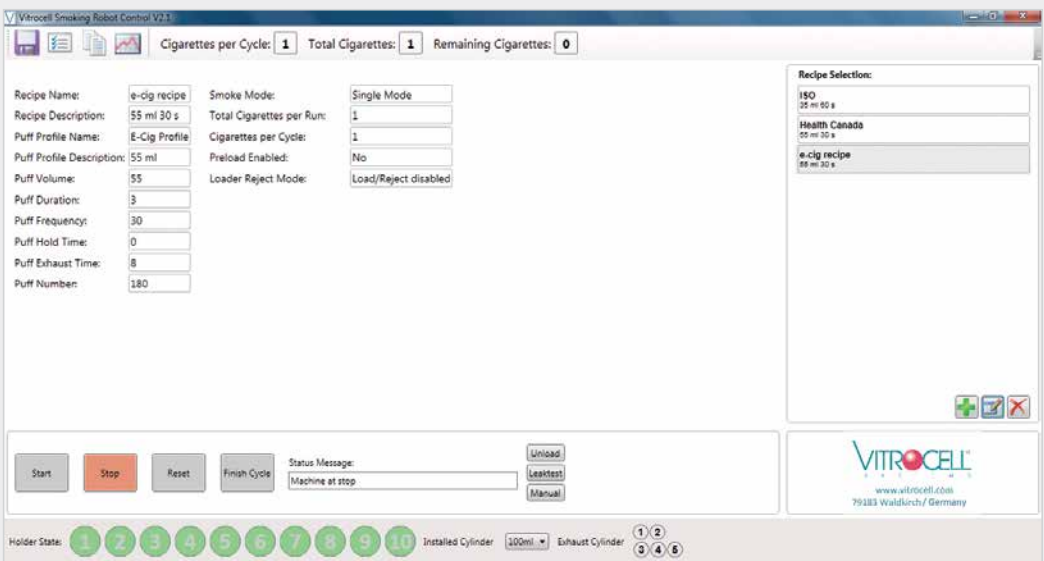


5 individual machine-controlled exhaust lines direct the smoke to 5 dilution systems.

Software & Controls

Electrical control box

The control box houses the controls for the stepper motors, sensors and pneumatic valves. The whole process is controlled by Beckhoff software in conjunction with Microsoft Windows 10®. This setup offers extensive possibilities for integration with common Microsoft Office® applications and the exchange of data with Excel®-sheets.



Smoking parameters

Advanced, user-friendly software with recipe edit functions for favourite smoking / vaping regimes:



- Puff volume: up to 200 ml
- Puff frequency: 4 – 250 s
- Puff duration: 0.1 – 15 s
- Puff exhaust duration: 0.5 – 15 s
- number of cigarettes per run: 300
- number of puffs: 1 – 250
- smoking modes: single, cycle, serial
- profiles: bell, square, human

Smoking modes

- Single, cycle and serial mode
- Pre-loading mode
- Cycle mode with system purging after each cycle

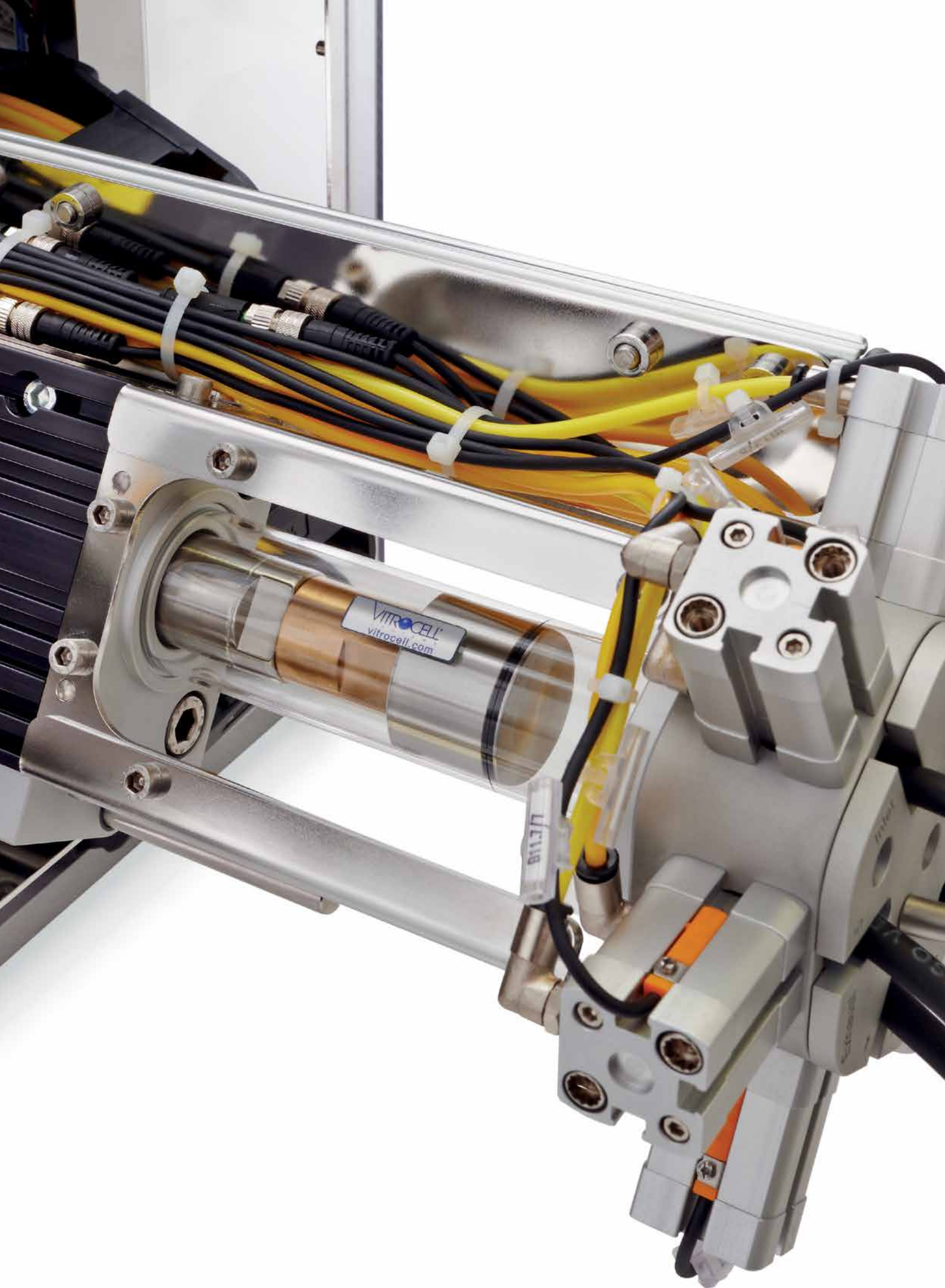


Technical Data

Dimensions electrical control box:	790 x 300 x 600 mm (L x W x H); 31 x 12 x 24 inches
Dimensions smoking platform:	940 x 690 x 670/694* mm (L x W x H) / (height without hood); 37 x 28 x 27/28 inches
Power supply:	1 x 208-240 V, 50/60 Hz, 16 A
Compressed air:	Operating pressure 6 bar (87 psi); system pressure 10 bar (145 psi)
Remote service module:	Included / Internet access mandatory

*platform opened





CHEMCONTROL Feature

Whole smoke and gas phase analysis of single puffs for Smoking Robots VC 10[®] / VC[®] 10 S-TYPE



The VITROCELL[®] VC 10[®] CHEMCONTROL Smoking Robot is specifically developed for the chemical and biological analysis of single puffs. The effects of whole smoke as well as the gas phase of each individual puff can be analysed by a special smoking regime and sampling unit.

Highly flexible smoking parameters combined with the compliance to ISO as well as Health Canada smoking regime requirements make the VC 10[®] CHEMCONTROL an efficient and extremely powerful analysis tool.

Special configuration for VC 10[®] CHEMCONTROL

Individual sampling points allow separate analysis of 8 puffs per cigarette.

The puffs 1 to 8 are guided to a total of 8 individual sampling points, where e.g. impingers or other analysis tools may be placed. The base robot is as above.

4 Cigarettes are loaded and lightened automatically. The unique valve and purging system allows for the following regime:

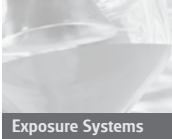
- Each first puff of cigarettes # 1 - # 4 is directed to sampling point # 1. After that there is the choice to purge the system. For this purpose the valve towards the cigarette holders is closed and the valve

towards the purging gas

(e. g. Synthetic Air) is opened.

The pump is performing 1...5 purging puffs. Thereafter the valve for the purging gas is closed and the valve towards the smoke ports opened.

- Each 2. puff of cigarettes # 1 - # 4 is directed to sampling point 2. Then purging takes place in the same way than above.
- Each 3. puff of cigarettes # 1 - # 4 is directed to sampling point 3. Then purging takes place in the same way than above.
- Same procedure for 4. until final puff 8 (or a fraction of final puff) which is directed to sampling point 8. Then purging takes place in the same way than above.



Exposure Systems



Dose Supply



Dilution



Racks & Carts



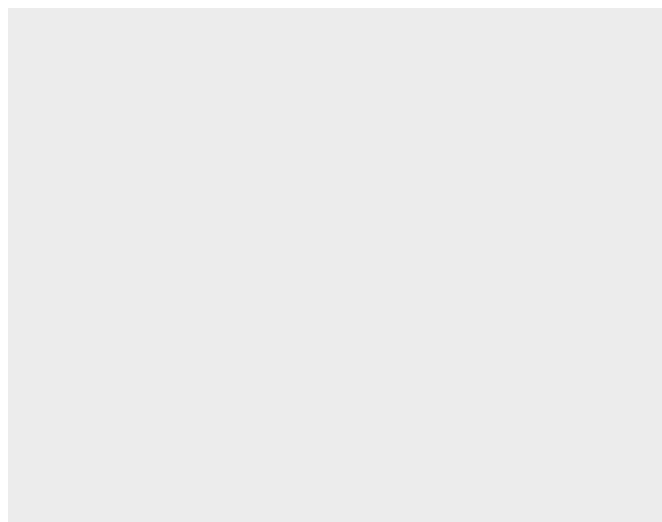
Dose Monitoring



Skin Exposure



Auxiliary Equipment



Human Puff Profiles

For Smoking Machine VC 1 / VC 1 S-TYPE and Smoking Robots VC 10[®] / VC 10[®] S-TYPE

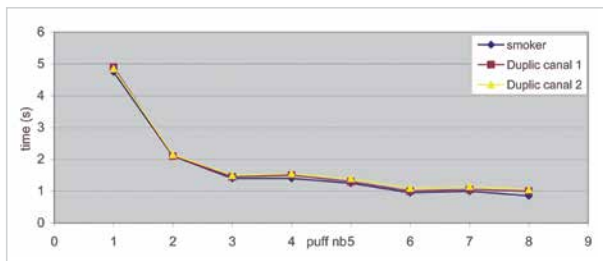
Direct Reading from Puff Analyzer Data Files



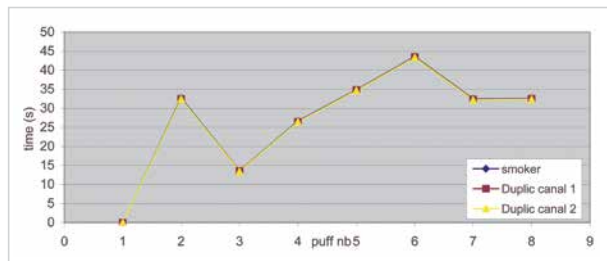
Human puff profile capability

This optional feature for the VC 1 and VC 1 S-TYPE smoking machine, VC 10[®] and VC 10[®] S-TYPE smoking robots offers the possibility to feed data of human puff profiles registered by Smoking Puff Analyzers to the machine controls.

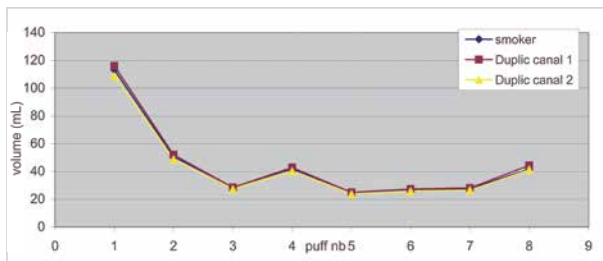
Puff time – precision of replication *



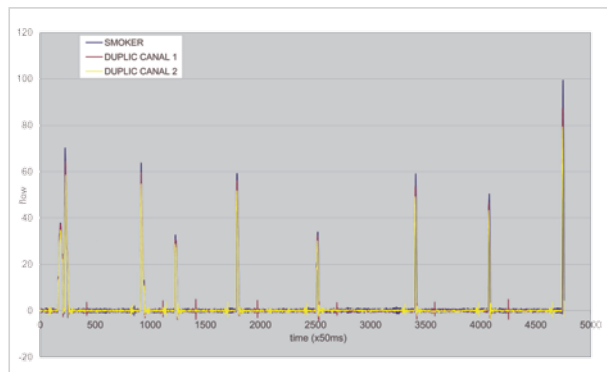
Inter puff time – precision of replication *



Puff volume – precision of replication *



Flow versus time – precision of replication *



*) Data from smoker compared with 2 channels of VC 10[®] smoking robot (VC 1 is using same technology).

COMPARISON VITROCELL® SMOKING MACHINES

#	Criteria	Smoking Machine VC 1	Smoking Machine VC 1 S-TYPE	Smoking Machine VC 1/7 and VC 1/8	Smoking Robot VC 10	Smoking Robot VC 10 S-TYPE
1	Smoking Ports	1	Up to 5	Up to 8	10	10
2	Loading	Manual	Manual	Manual	Automatic/Option: Manual	Automatic/Option: Manual
3	Lighting	Manual	Manual	Manual	Automatic by plate	Automatic by hot air
4	Butt Extraction	Manual	Manual	Manual	Automatic	Automatic
5	Butt Length Sensor	Yes	Yes	Yes	Yes	Yes
6	Cylinder Volume	200 ml	200 ml	200 ml	100 ml	200 ml
7	Option 1	300 ml	-	-	50 ml	100 ml
	Option 2	600 ml	-	-	200 ml	-
	Puff Exhaust Exits	1	Up to 3	7 and 8	1	5
	Option 1	-	-	-	2	10
	Option 2	-	-	-	4	15
8	Option 3	-	-	-	5	-
	Cambridge Filter for Gas Phase	Yes	Yes	Yes	Yes	Yes
9	Puff Profile	ISO/Bell/Square Shaped	ISO/Bell/Square Shaped	ISO/Bell/Square Shaped	ISO/Bell/Square Shaped	ISO/Bell/Square Shaped
10	Human Puff Profiles	Option	Option	Option	Option	Option
	Smoke Recipe Storage	Yes	Yes	Yes	Yes	Yes
11	Purging after last puff	Option	Option	Option	Option	Option
12	Chemcontrol	-	-	-	Option	-
13	Puffs parameter logging	Yes	Yes	Yes	Yes	Yes
14	Platform concept	-	-	-	-	Yes
15	Docking stations	-	-	-	-	Yes
16	Size cigarette magazine	-	-	-	20/50	300
17	Holders for e-cigarettes	Yes	Yes	Yes	Yes	Yes
18	Button actuator option	for 1 e-cigarette	for 5 e-cigarettes	for 7 or 8 e-cigarettes	for 1 e-cigarette	for 10 e-cigarettes
19	Heated smoke path	Option	Option	Option	-	Yes
20	Max. syringe drives	1	1	7 or 8	1	3
21	Cleaning procedure	very easy	very easy	very easy	easy	very easy

About VITROCELL®

VITROCELL® exclusively concentrates on the developing, producing, installing, training and servicing of advanced *in vitro* exposure systems.

The VITROCELL® Systems' team is driven by their vision for new in-vitro standards through state-of-the-art technology, highly qualified workmanship and absolute client dedication. VITROCELL® has successfully collaborated with clients from leading research institutes, contract research organizations, regulatory authorities or industrial laboratories across the world. Working with our team experts, all modules have been tailored to create durable and complete turnkey-systems for *in vitro* inhalation toxicology. Gases, environmental atmospheres, nano particles and complex mixtures are analyzed on lung cells at the air/liquid interface using these systems. VITROCELL® technologies are also applicable to solutions for skin research.

Over a decade of devotion to research in this specific field has given our team of design & precision manufacturing specialists the opportunity to mentor highly diversified and complex projects **from conception to completion**. We strive to become a constructive member of each research team, providing support when it is needed, advice when it is required and modules of the highest quality, which are even polished by hand before leaving here to be integrated into your workspace. Every piece of our German engineered equipment is manufactured to the highest of standards – yours.

For more information
please scan the QR-Code:



VITROCELL® Systems GmbH
Fabrik Sonntag 3
79183 Waldkirch
Germany

Tel. +49 7681 497 79-50
Fax +49 7681 497 79-79
Email: info@vitrocell.com
www.vitrocell.com

