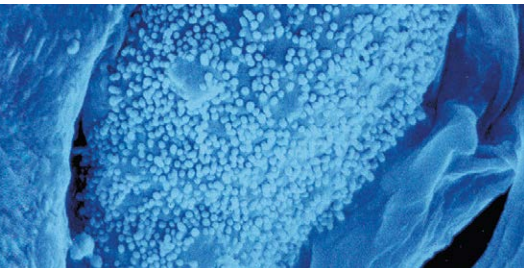


Advanced in vitro exposure systems

VITROCELL VC 10[®] SMOKING ROBOTS

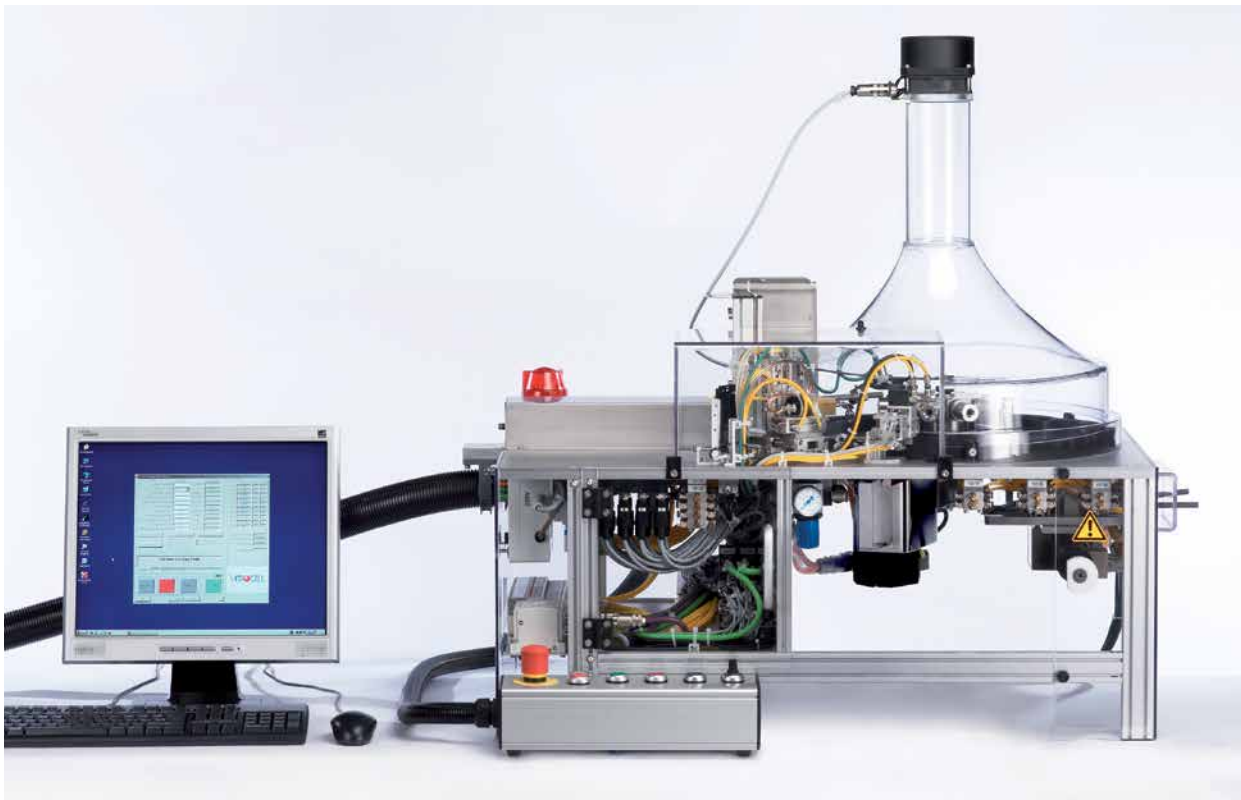


Options for e-cigarettes

- square puff profiles
- higher puff volumes
- lighter off mode

VITROCELL VC 10[®] SMOKING ROBOT

Specially designed for *in vitro* research and development



Objective

The smoking machine VC 10[®] is specifically designed and manufactured to fulfill the requirements of whole smoke and aerosol generation for *in vitro* experiments. Suitable for conventional and electronic cigarettes, the VC 10[®] offers significant advantages over other commercial smoking machines:

Generation of smoke with the shortest distance to cell cultures

For the success of an experiment with mainstream tobacco smoke it is vital that the distance between the smoke generation (cigarette holders) and the VITROCELL[®] cell exposure system is as small as possible to avoid aging and to guarantee authentic smoke-composition.

Open and flexible system / incorporation of other analytical tools

The robot is designed to allow easy access to all tubes, filters and the pumping system. Additional analytical equipment relevant to the experiment can be easily installed individually.

Freely programmable parameters

The computer system caters for 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 such as puff duration, puff volume, puff frequency and exhaust duration can be defined according to experiment requirements.



Statistics

Smoking process data are logged into an Excel® sheet for further processing.

Machine dimensions suitable for constrained lab workplaces.

The robot is divided into 3 major components: computer, control box and smoking platform. The smoking platform is the only element that must be placed in the direct area of the experiment; all other components can be located anywhere in the lab.

All components are easy to clean

In particular the work with unfiltered mainstream smoke demands frequent

cleaning of all robot parts in contact with smoke. Cleaning must take place after each experiment to avoid any residual product contamination of subsequent experiments. Easy access to all component parts ensures quick and efficient cleaning.

Compatibility with existing lab systems

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 when the interchange option is purchased.

Bell shaped and square puff profile capabilities

Human puff profile capability

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.

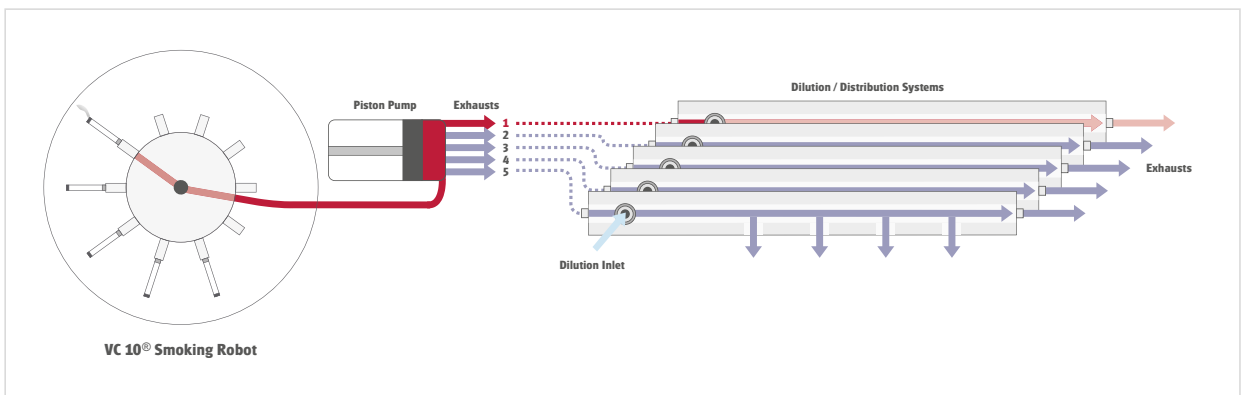
Service

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



Multi-port exits (Option)

2, 4 or 5-port exits enable to operate the robot with multiple dilution systems.



Allocation of each cigarette port to a specific piston pump exhaust line and dilution system.

Loading

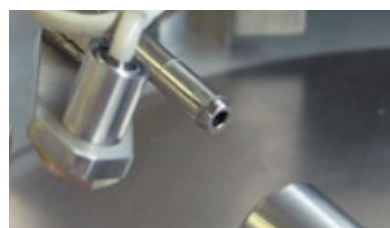
Magazine

The standard magazine takes up to 20 cigarettes and larger versions are also available. They are suitable for storage in the climatization chamber for pre-conditioning of the cigarettes.



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

The loading of the cigarettes into the cigarette holders takes place fully automatically and without damage to the cigarette. The cigarette holders are equipped with labyrinth seals as required by ISO 3308:2012.



VITROCELL® Holder System for e-cigarettes

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

New designs of ENDS (Electronic Nicotine Delivery Systems) products lead to a large variety of different shapes which make the insertion into conventional holders with labyrinth seals impossible.

VITROCELL® has developed a new holder system which is flexible to adjust to different shapes. It is compatible with all VITROCELL® Smoking Machines & Robots.

In most cases the exchange of the inner sealing is sufficient to adjust for a specific shape.





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.

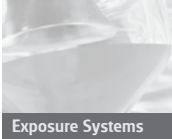


The Vapestarter unit is available for different dimensions of tank products

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





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 by a linear motor with high precision. The pump can be dismantled for cleaning and refitted again in a few minutes.



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.



Smoking and butt extraction

Hood for sidestream smoke evacuation

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 extractor

The cigarette is forwarded to the extraction position and removed from the holder. The ashtray is kept permanently clean with a brush.

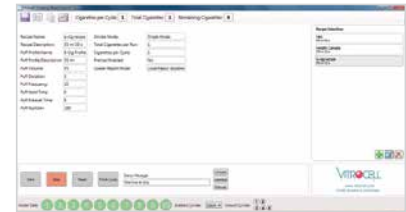




Software & Controls

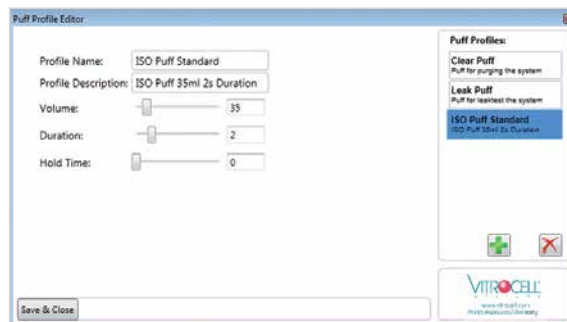
Smoking parameters

The operation 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.



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
- Lighter off mode
- Cycle mode with system purging after each cycle



Technical Data

Dimensions electrical control box:	600 x 300 x 600 mm (L x W x H); 24 x 12 x 24 inches
Dimensions smoking platform:	1000 x 600 x 300 mm (L x W x H) / (height without hood); 40 x 24 x 12 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

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:

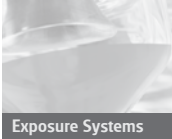
- Each first puff of cigarettes # 1 - # 4 is directed to sampling point # 1. After that there is the choice to purge the system. For this purpose the valve towards the cigarette holders is closed and the valve

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



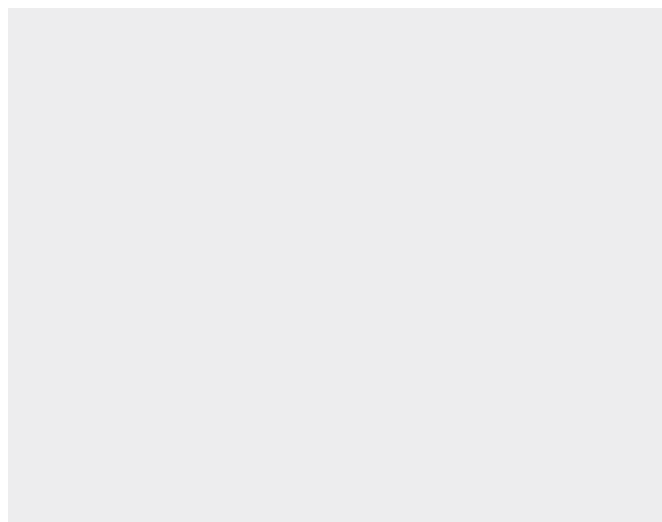
Dose Monitoring



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

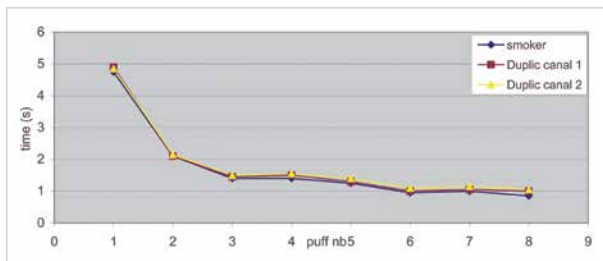
Direct Reading from Puff Analyzer Data Files



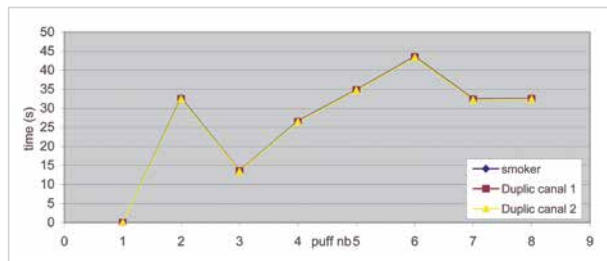
Human puff profile capability

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.

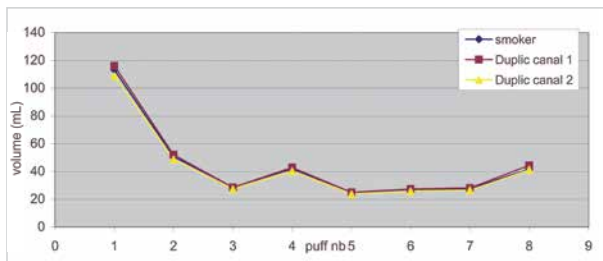
Puff time – precision of replication *



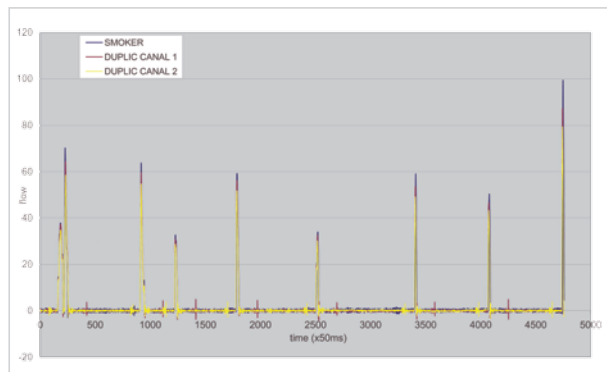
Inter puff time – precision of replication *



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:



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