

# VITROCELL® VC 1 Smoking Machine with Shisha Option

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## Background

The manual smoking machine VC 1 is specifically designed and manufactured to fulfill the requirements of *in vitro* experiments.

To this date the machine is suitable for conventional and electronic cigarettes. Our latest design upgrade for the VC 1 smoking machine allows now the use of water pipes (shishas) for *in vitro* experiments. The essential requirement for the “Shisha smoking” application is a significant larger puff volume of up to 600 mL. In order to meet the requirement for such a high puff volume, without compromising the accuracy of the puff profile, it is possible to equip the machine with different cylinder sizes (200 mL, 300 mL and 600 mL).

The conversion procedure to the higher/smaller puff volume is possible within less than 10 minutes. The Shisha option is designed in a way that an already existing and used VC 1 smoking machine can be easily and cost-efficient upgraded to a VC 1 with “Shisha option”.

## Overview technical data

### Usable for

- Combustion cigarettes
- E-Cigarettes
- Shisha/water pipe
- Cigars

### Adjustable puff parameters

- Puff volumes: 5 – 600 mL (Different cylinders)
- Puff duration: 0.1 – 10 s
- Puff frequency: 1.6 – 250 s
- Puff exhaust duration: 1.2 – 15.0 s
- Max. puff count: 1 – 999 puffs

### The system matches

- ISO 3308 35 mL/60 sec puff regime
- Massachusetts 45 mL/30 sec puff regime
- Health Canada 55 mL/30 sec puff regime
- CRM81 Square 55 mL/30 sec puff regime
- Square 95 mL/30 sec puff regime
- AFNOR XP D90-300-3 for e-cigarettes
- Shisha smoking

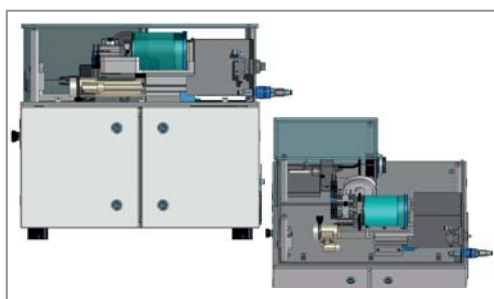


Fig. 1: VC 1 with 600 mL cylinder

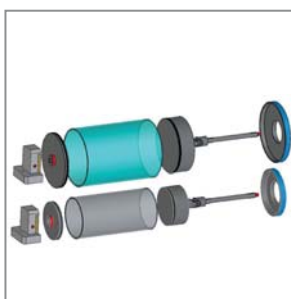


Fig. 2: Change-Set 300 mL and 600 mL



Fig. 3: Existing VC 1 smoking machine



Fig. 4: VC 1 smoking machine with „Shisha option”

To validate the VC 1 smoking machine with the Shisha upgrade package different puff profiles were checked. We simulated a shisha profile with the below mentioned puff parameters as well as ISO and HCl puff profiles for combustion cigarettes. The results demonstrate that the puff profiles are well represented by the smoking machine irrespective of high or low puff volumes are applied.

## Shisha puff profile

- Puff volume: 530 mL ± 10 mL
- Puff duration: 2.6 s ± 0,1 s
- Puff frequency: 20 s
- Puff profile: Square wave

## HCl puff profile

- Puff volume: 55 mL
- Puff duration: 2 s
- Puff frequency: 30 s
- Puff profile: Bell shaped

## ISO puff profile

- Puff volume: 35 mL
- Puff duration: 2 s
- Puff frequency: 60 s
- Puff profile: Bell shaped

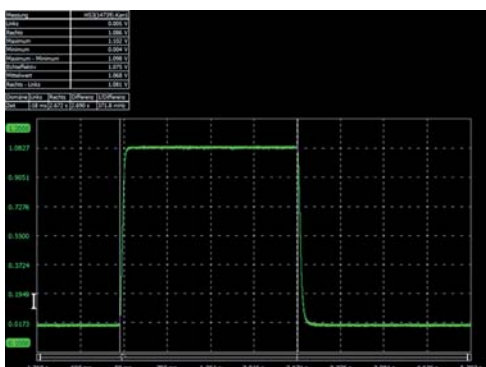


Fig. 5: Shisha puff profile 530 mL

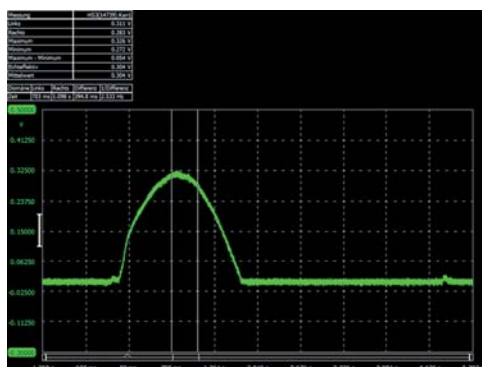


Fig. 6: HCl profile 55 mL/30 sec puff regime

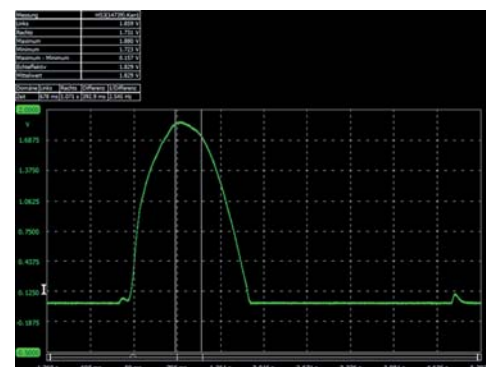


Fig. 7: ISO profile 35 mL/60 sec puff regime