

# Performance of the Samco™ Capillary Transfer Pipette for single-use liquid sample collection and dispensing at preset volumes

Yuka Kojima, Emelia DeForce, PhD, Anne Smith, PhD, and Eric Niederkofler, PhD, Thermo Fisher Scientific, Tempe Arizona, USA

## ABSTRACT

The Thermo Scientific™ Samco™ Capillary Transfer Pipette (CTP) is a single use micro-liter volume liquid collection tool with an innovative design that utilizes capillary action to aspirate to a specific, preset volume facilitating one-hand operation. In this study, two different preset volumes (25 µL and 50 µL) of Samco™ CTP were tested for sample collection and dispense performance. To compare, glass capillary transfer pipettes (25 µL and 50 µL) and Competitor M's CTP (20 µL and 50 µL) were tested. The Samco™ CTP performance was superior as a disposable sample collection tool at a preset volume because it dispensed more precisely, is safer than glass, and circumvents contamination issues compared to the glass capillary transfer pipettes. Furthermore, Samco™ CTP performed with higher inter-day reproducibility for both single user and multiple users and had a complete dispense of the sample in contrast to Competitor M's CTP. Taken together, the Samco™ CTP outperformed the glass capillary transfer pipettes and Competitor M's CTP.

## INTRODUCTION

Many kits for rapid point-of-care testing or at-home testing require precise yet micro-volume liquid samples from a patient. Having a sample collection tool capable of consistently and accurately obtaining a set minimum volume is critical for these types of tests. A disposable, user-friendly, and safe option protects not only the sample and analytical test device from contamination but the user from any risk while obtaining a sample.

With an innovative design, Samco™ CTP provides a rapid, accurate and micro-volume liquid sample collection at a preset volume. The CTP is made from LDPE plastic resin, a material that is non-toxic (free of latex, DEHP, BPA, and slip agents) and enables a flexible yet durable product providing safety for the user and patient during sample collection. The Samco™ CTP is 9001:2015<sup>1</sup> and ISO 13485:2016<sup>2</sup> compliant and therefore, is manufactured with the highest quality standards for design of a product including medical devices.

The use of the CTP is simple. Aspiration of a liquid sample starts by capillary action when liquid touches the open end of the CTP and stops at the preset set volume when the sample comes in contact with an engineered vent hole in the pipet shaft. The sample is safely contained with no loss during transfer by keeping the pipette stem downward. To dispense, simply squeeze the bulb. Because of the unique design, one-handed operation during collection, transfer, and dispensing of sample is feasible and no special training is required.

To test these unique attributes, a direct comparison of Samco™ CTP to both glass capillary transfer pipette, known as the golden standard of CTP, and competitive plastic CTP was performed.

## MATERIALS AND METHODS

- Samco™ CTP:
  - 25 µL (Catalog number 1028-100)
  - 50 µL (Catalog number 1029-100)
- Competitor M capillary transfer pipette (20 µL and 50 µL)
- Glass capillary transfer pipettes and reusable dispense bulb (25 µL and 50 µL)
- Balance (capable of readings down to 0.0001g)
- Normal Human Whole Blood, with Heparin (purchased as "for research use only") (BioIVT.com)
- Single channel pipette (10 – 100 µL) and tips
- Ultrapure water (Cayman Chemical, No 400000 or similar)
- Disposable Petri dishes
- Disposable general-purpose transfer pipettes with standard bulb (Thermo Scientific™ 202-1SPK or similar)
  - Nitrile gloves
  - Water bath
  - Thermometer

Image 1. Samco™ Capillary Transfer Pipette



- Heat whole blood sample to 37° C in water bath.
- Determine the density ratio of the blood to ultrapure water (density of water equals 1.0 g/mL (0.99403 g/cm<sup>3</sup>) at 35 ° C<sup>3</sup>) by averaging the weight from preset volumes of the two types of liquid (measure n = 5 times). The ratio used to convert the weight to volume of the whole blood sample was calculated as follows.  
 Example calculation:  

$$\text{Average density ratio} = \frac{\text{Average weight of 50 } \mu\text{L whole blood (g)}}{\text{Average weight of 50 } \mu\text{L water (g)}} = \frac{0.05312}{0.05102} = 1.041$$

$$\text{Volume of blood dispensed (}\mu\text{L)} = \text{weight of blood (g)} / \text{density ratio} * \text{unit conversion} = 0.0269 \text{ g} / 1.041 * 1000 = 25.84 \mu\text{L}$$
- Dispense a droplet of blood sample on a gloved hand using a disposable general-purpose transfer pipette with standard bulb.
- Aspirate the sample using the test CTP and dispense liquid sample into the petri dish.
- Record the weight of sample dispensed by each test capillary transfer pipette.
- Repeat 3-5 with inter-day by one technician, inter-user by two technicians to determine variability (n = 25 - 40 times)

## RESULTS

Figure 1. Dispense performance results of CTP at 20 µL and 25 µL preset volumes

Overall, Samco™ CTP demonstrated the most accurate preset volume dispense (25 µL, -0.16% to 5.57%). Glass capillary transfer pipette has the best repeatability (2.26 to 2.53%) however dispensed consistently below the target volume of 25 µL (21.8 to 23.46 µL). Competitor M's CTP failed the most with up to 4 failures to aspirate or dispense.

25 µL Samco Capillary Transfer Pipette					20 µL Competitor M's CTP					25 µL Glass capillary transfer pipette					
	Day 1 User 1	Day 1 User 2	Day 2 User 2		Day 1 User 1	Day 1 User 2	Day 2 User 2		Day 1 User 1	Day 1 User 2	Day 2 User 2		Day 1 User 1	Day 1 User 2	Day 2 User 2
n	39	39	40	n	37	40	40	n	40	40	40	n	40	40	40
Failed	1	0	0	Failed	4	0	0	Failed	2	0	0	Failed	0	0	0
Mean (µL) dispensed	25.67	24.96	26.39	Mean (µL) dispensed	18.02	19.46	21.44	Mean (µL) dispensed	23.46	23.07	21.8	Mean (µL) dispensed	44.74	45.62	44.92
%CV (day)	4.87%	4.87%	4.47%	%CV (day)	8.81%	6.85%	8.55%	%CV (day)	2.26%	2.53%	2.27%	%CV (day)	3.03%	2.67%	2.65%
Accuracy	2.70%	-0.16%	5.57%	Accuracy	-9.90%	-2.71%	7.18%	Accuracy	-6.15%	-7.72%	-12.79%	Accuracy	-10.52%	-8.75%	-10.16%
Inter-User Variability	4.87%			Inter-User Variability	7.85%			Inter-User Variability	2.40%			Inter-User Variability	2.85%		
Inter-Day Variability	4.67%			Inter-Day Variability	7.75%			Inter-Day Variability	4.00%			Inter-Day Variability	2.66%		

Figure 2. Dispense performance results of CTP at 50 µL preset volume

The 50 µL Samco™ CTP dispensed with accuracy between 3.36 to 6.32% and did not dispense under the target volume of 50 µL (51.87 to 53.16 µL). Glass capillary transfer pipette has the best repeatability (2.65 to 3.03%) however, dispensed consistently below the target volume of 50 µL (45.62 to 44.92 µL). The most failed pipettes were observed from Competitor M's CTP (1-2 failures).

50 µL Samco Capillary Transfer Pipette					50 µL Competitor M's CTP					50 µL Glass capillary transfer pipette					
	Day 1 User 1	Day 1 User 2	Day 2 User 2		Day 1 User 1	Day 1 User 2	Day 2 User 2		Day 1 User 1	Day 1 User 2	Day 2 User 2		Day 1 User 1	Day 1 User 2	Day 2 User 2
n	32	25	30	n	30	30	30	n	30	30	30	n	30	30	30
Failed	0	2	0	Failed	1	2	2	Failed	0	0	0	Failed	0	0	0
Mean (µL) dispensed	51.87	51.68	53.16	Mean (µL) dispensed	50.43	50.58	50.39	Mean (µL) dispensed	44.74	45.62	44.92	Mean (µL) dispensed	44.74	45.62	44.92
%CV (day)	3.82%	4.03%	3.04%	%CV (day)	4.07%	3.37%	4.55%	%CV (day)	3.03%	2.67%	2.65%	%CV (day)	3.03%	2.67%	2.65%
Accuracy	3.74%	3.36%	6.32%	Accuracy	0.86%	1.17%	0.78%	Accuracy	-10.52%	-8.75%	-10.16%	Accuracy	-10.52%	-8.75%	-10.16%
Inter-User Variability	3.46%			Inter-User Variability	3.73%			Inter-User Variability	2.85%			Inter-User Variability	2.85%		
Inter-Day Variability	3.52%			Inter-Day Variability	4.00%			Inter-Day Variability	2.66%			Inter-Day Variability	2.66%		

Figure 3. Individual performance of Samco™ CTP vs. Glass CTP at preset volumes of 25 µL and 50 µL

The highlighted area (darker red and darker blue) indicates the target preset volume plus 10%. As indicated in both graphs by a red arrow, the glass pipets were consistently below the target preset volume whereas the Samco™ CTP (blue arrows) was within the target preset volume.

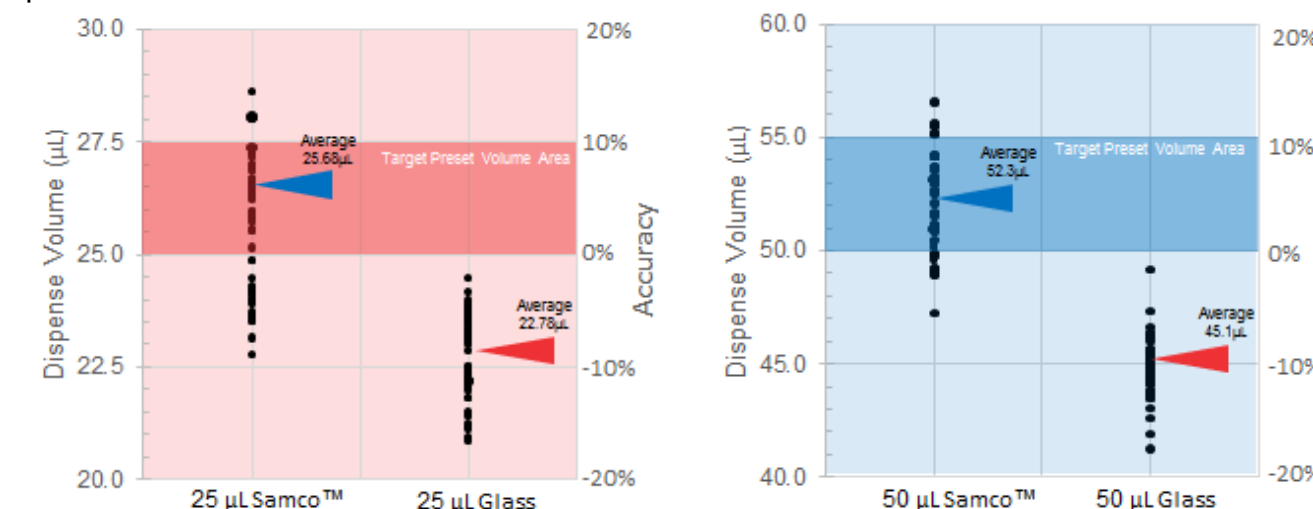
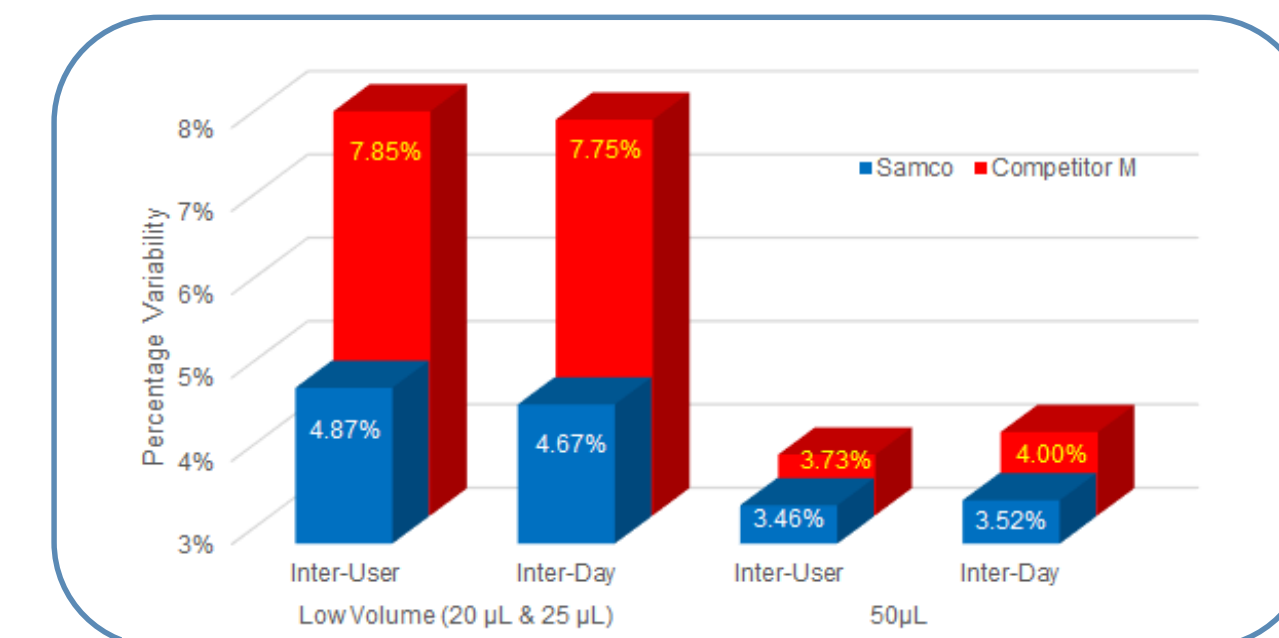


Figure 4. Volume dispense variability of Samco™ CTP vs. Competitor M's CTP

Samco™ CTP has less volume dispense variability (Fig. 1 and 2) regardless of inter-user or inter-day data points. At the low preset volumes Samco™ CTP significantly outperformed Competitor M up to 3%. Although the variability is less using the 50 µL pipet, the Samco™ CTP still performed better than competition.



## CONCLUSIONS

The results from this study indicate that the Samco™ CTP performs with more accuracy and repeatability of liquid sample collecting and dispensing compared to the golden standard of the glass capillary transfer pipette and a competitor transfer pipette.

### Samco™ CTP vs. Glass CTP:

The single use Samco™ CTP collection device demonstrated several benefits over glass capillary transfer pipette including dispense volume, operation, safety, and packaging. The Samco™ CTP consistently dispensed at the target volume of either 25 or 50 µL. The single-handed operation allows for ease of use and the disposable design protects samples from contamination. The fact that it is manufactured from flexible and non-toxic LDPE plastic resin and is packaged as single use, provides additional safety for samples and users. Because of the vent hole in the Samco™ CTP and Competitor M's CTP, there were no issues with accurate volume aspiration. However, in the glass capillary transfer pipette, there is no vent hole and therefore, the sample continued to draw up past the volume required. Lastly, the glass capillary tube requires 2 hands because of the reusable dispense bulb.

### Samco™ CTP vs. Competitor M's CTP:

Samco™ CTP had more accurate dispense performance, a reduced failure rate, and it delivered better repeatability by an individual or across multiple users compared to competition. Furthermore, there was incomplete dispensing of the sample using the competitor M's CTP. Lastly, Samco™ CTP can be custom manufactured to adhere to a desired volume for the user's specific applications.

Taken together, the Samco™ CTP has superior performance of disposable microliter volume liquid sampling compared to other CTPs. It provides accurate and easy liquid collection, dispensing, and is user-friendly while preventing contamination.

## REFERENCES

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## TRADEMARKS

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Ordering information							
Product	Draw	Stem length	Stem diameter	Quantity per bag	Quantity per pack	Quantity per case	Cat. No.
Samco capillary transfer pipettes	50 µL	3.87 cm	2.34 mm	100	500	5,000	1029-100
Samco capillary transfer pipettes	25 µL	2.26 cm	2.34 mm	100	500	5,000	1028-100

Find out more at [thermofisher.com/capillarytransferpipettes](http://thermofisher.com/capillarytransferpipettes)