# Dispense Performance of the Samco Exact Volume Transfer Pipette

Key Words: Exact Volume Transfer Pipette, Pre-set volume, Liquid transfer, Disposable

## Abstract

Understanding the performance of a liquid handling device is of interest when trying to determine the correct tool for the transfer of a biological sample. The Thermo Scientific™ Samco™ Exact Volume Transfer Pipette (EVP) is an innovative, unique, and disposable liquid handling device that can be used to transfer samples at a preset volume of choice. In order to better understand the performance of the Samco EVP, a study was performed to determine the accuracy and precision using both urine and plasma.

## Introduction

Samco EVPs are disposable liquid handling devices with preset volumes ranging from 20 µL to 400 µL that allow collection and dispensing of samples. The dual bulb design allows the bottom bulb to reserve the overflow whereas the top bulb helps to draw and dispense the sample that is held in the stem of the pipette. The EVP is designed to be used in both in an upright and angled position during aspiration, and therefore, it is suitable for transfer of a liquid sample from an open container such as blood collection tube or open top vial.

The length and diameter of the stem determines the preset volume of the liquid sample. Samco EVPs are ideal for use in rapid diagnostic kits or any application requiring accurate and precise volume measurements. In order to determine the accuracy and precision when using Samco EVPs a study was performed using both urine and plasma.

## Materials and Methods

- Samco Exact Volume Transfer Pipettes (4 sizes 50 µL, 100 µL, 200 µL, and 400 µL Cat. Nos.: 930NL, 787NL, 941NL, 976NL)
- Human Urine (BioIVT, customized for research use only)
- Human Plasma (ProMed Dx , customized for research use only)
- UltraPure water (Cayman Chemical UltraPure Water Cat. No. 400000, or similar)
- Calibrated balance (capable of reading down to 0.0001 g)
- Disposable conical centrifuge tubes 15 – 50 mL (Thermo Scientific™ Nunc™ 15 and 50 mL Conical Sterile

Polypropylene Centrifuge Tubes Cat. Nos. 339650 or 339652, or similar)

- Disposable general-purpose transfer pipettes (Samco Transfer Pipette Cat. No. 202-1SPK or similar)
- Calibrated single channel pipette (10 – 100 µL) and tips (Thermo Scientific™ F1-ClipTip™ Variable Volume Single-Channel Pipette Cat. No. 4641200N and Thermo Scientific™ ClipTip™ Non-Filtered Pipette Tip 200 µL Cat. No. 94410317 or similar)

1. Bring reagents and samples to room temperature (25°C)
2. Tare the weight of a 15 mL or 50 mL conical tube
3. Aspirate the sample using the EVP (50 µL, 100 µL, 200 µL, and 400 µL sizes) and dispense the sample into the tared conical tube
4. Record the weight of sample dispensed by each EVP size
5. Repeat steps 2-4 (n=30 times) with each sample type
6. Repeat steps 2-5 with a different user (to determine inter-user variability)
7. In order to determine dispense volumes of samples with varying biological characteristics, density of the sample must be included in the calculations
8. To determine the density of the sample tested (in this case urine or plasma), weigh 100 µL of each sample 5 times using a calibrated pipettor and calibrated balance and calculate the average weight
9. Calculate the density of the each sample using this equation
    - Density (g/µL) = Weight (g) / Volume (µL)
    - For ex: Density (g/µL) = 0.1015 (g)/100 (µL) = 1.015e-3 (g/µL)
10. Using the density calculated above, convert the weight to volume for each measurement group to determine variability
    - Volume (µL) = Weight (g)/Density of sample type (g/µL)
    - For ex: Volume (µL) = 0.05 (g) /1.015e-03 (g/µL) = 49.26 (µL)

## Results

In this study, accuracy is reported as a percentage and is defined as how close the volume dispensed by the EVP is to the known preset volume. Accuracy is calculated by taking the average of the volumes measured (n=30) and subtracting from the preset volume of the EVP tested. Then, to calculate the percentage, divide by the preset volume and multiply by 100. Note that a negative value indicates the volume is less than the preset volume.

Precision (as a measure of repeatability) is reported as a percentage and is defined as how close the measurements are to each other. Precision is calculated by dividing the standard deviation of the measurements (n=30) by the average of the measurements (n=30) and multiplying by 100.

The urine sample accuracy results (Figure 1) show that the average (n=30) range of dispense volumes for the preset 50 µL, 100 µL, 200 µL, and 400 µL EVP are 48.4 - 50.0 µL, 97.4 - 102.6 µL, 196.0 - 198.0 µL, and 389.2 - 405.8 µL respectively. The average percent accuracy for all preset volumes is 1.9% and the range of percent accuracy of the volume of urine dispensed for all users and preset volumes is between 0.04% and -3.2%. The precision for individual users is between 1.3 - 5.4% with an average of 3.1% and the precision for multiple users (n=30 each) is between 1.5 - 4.5% with an average of 3.2% for all preset volumes.

The plasma sample results (Figure 2) show that the average (n=30) range of dispense volumes for the preset 50 µL, 100 µL, 200 µL, and 400 µL EVP are 48.2 - 48.4 µL, 96.4 - 97.9 µL, 190.9 - 195.3 µL, and 382.9 - 387.5 µL respectively. The average percent accuracy for all preset volumes is 3.3% and the range of percent accuracy of the volume of plasma dispensed for all users and all preset volumes is between -2.1% and -4.5%. The precision for individual users is between 1.1 - 9.9% with an average of 3.6% and the precision for multiple users (n=30 each) is between 1.8 - 7.7% for with an average of 3.9% for all preset volumes.

Taken together, the average accuracy across both sample types was 2.6% and the average precision for individual users is 3.4% whereas the average for multiple users is 3.6% across both sample types.

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**Figure 1. Dispense performance of the Samco Exact Volume Transfer Pipette using urine**

| Preset volume | User | Average dispense volume | Accuracy | Precision | | Cat No. |
|---|---|---|---|---|---|---|
| | | | | Individual user | Multiple users | |
| 50 µL | A | 50.0 µL | 0.04% | 3.4% | 4.5% | 930NL |
| | B | 48.4 µL | -3.2% | 5.4% | | |
| 100 µL | A | 97.4 µL | -2.6% | 3.0% | 4.2% | 787NL |
| | B | 102.6 µL | 2.6% | 5.1% | | |
| 200 µL | A | 196.0 µL | -2.0% | 1.5% | 2.5% | 941NL |
| | B | 198.0 µL | -1.0% | 3.2% | | |
| 400 µL | A | 389.2 µL | -2.7% | 1.3% | 1.5% | 967NL |
| | B | 405.8 µL | 1.4% | 1.8% | | |

**Figure 2. Dispense performance of the Samco Exact Volume Transfer Pipette using plasma**

| Preset volume | User | Average dispense volume | Accuracy | Precision | | Cat No. |
|---|---|---|---|---|---|---|
| | | | | Individual user | Multiple users | |
| 50 µL | A | 48.4 µL | -3.2% | 2.0% | 3.8% | 930NL |
| | B | 48.2 µL | -3.6% | 4.9% | | |
| 100 µL | A | 96.4 µL | -3.6% | 4.5% | 7.7% | 787NL |
| | B | 97.9 µL | -2.1% | 9.9% | | |
| 200 µL | A | 195.3 µL | -2.3% | 1.1% | 2.4% | 941NL |
| | B | 190.9 µL | -4.5% | 3.2% | | |
| 400 µL | A | 382.9 µL | -4.3% | 1.8% | 1.8% | 967NL |
| | B | 387.5 µL | -3.1% | 1.7% | | |

## Conclusions

The data from this study indicates that Samco™ Exact Volume Transfer Pipettes in all preset sizes including 50 µL, 100 µL, 200 µL, and 400 µL perform with accuracy of 2.6% and precision of 3.4% for individual users and 3.6% for multiple users across both sample types (urine and plasma) when transferring biological samples. The average accuracy when transferring urine was 1.9% (compared to plasma which was 3.3%) and was closer to the preset volume of the EVPs because urine is less viscous than plama resulting in less sample retention in the shaft of the EVP therefore less loss of sample during handling. The same pattern followed for precision where individual urine average precision was 3.1% (whereas plasma 3.6%) and the average precision for multiple users in urine was 3.2% whereas the average plasma precision for multiple users is 3.9%.

In conclusion, this demonstrates that the characteristics of the sample can affect the accuracy and precision of the EVPs and should be taken into consideration when choosing the right product for liquid transfer. Please note that it is important to test the EVP of choice with the sample to be transferred in order to validate the EVP works properly in the specific application needs.

Find out more at **thermofisher.com/samcoevp**

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