APPLICATION NOTE

FRC Validation using a Lung Model

1 Introduction

This document validates the algorithms for FRC computation in EasyOne Pro LAB using a lung model with known volumes. The following equipment is used for the validation:

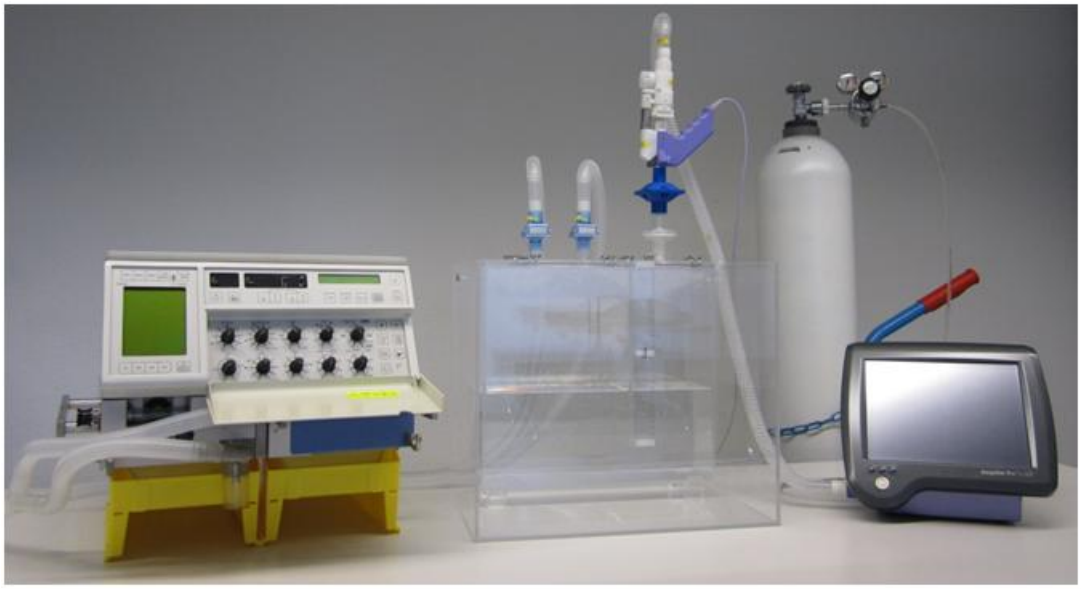
- EasyOne Pro SN 600'003.
- Lung model proposed by Singer et al [1].

2 Methods

In total, 44 measurements have been performed. The tidal volume varied between 0.3 l and 2.0 l. The target FRC varied between 0.27 l and 4.14 l. The breathing frequency varied between 10 and 20 breaths per minute. Data was recorded and evaluated with EasyWarePro (V1.4).

The FRC measurement by N_2 washout has been validated using a lung model proposed by Singer et al, see [1]. In total 44 bench test measurements have been performed. Tidal volume (Vt) was varied between 0.3 and 2.0 l, the respiratory rate varied between 10 and 20 min^{-1}, the target FRC volume varied between 0.3 and 4.1 l.

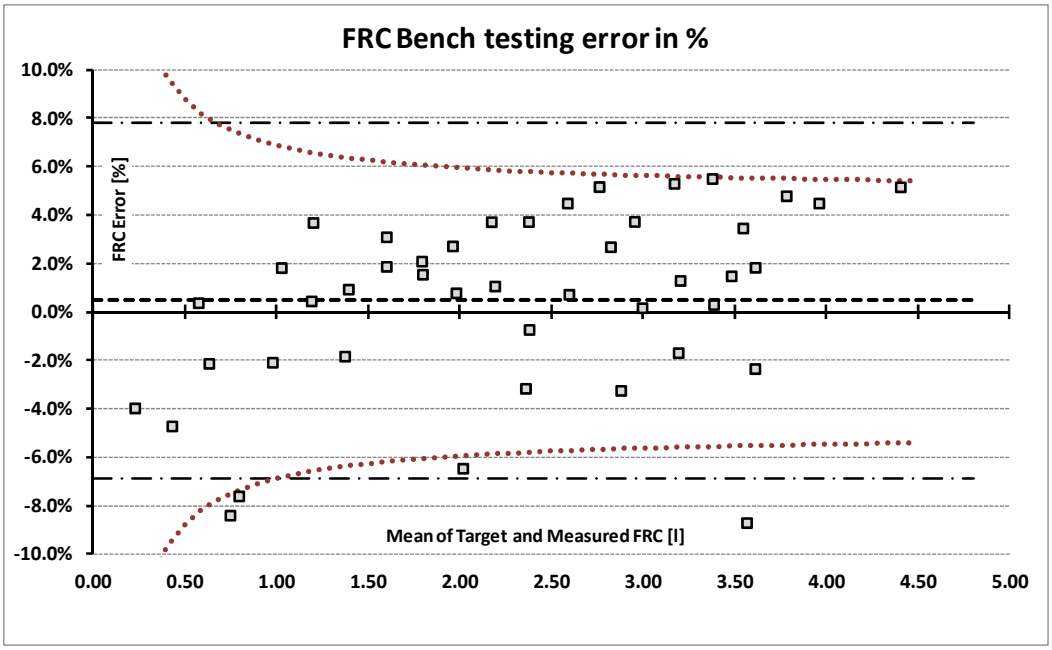
The following picture shows from left to right the following components: Ventilator (Dräger Evita), water filled lung model, oxygen gas bottle and EasyOne Pro LAB. For the actual tests, additional heating was used to bring the water to 37 °C. The following picture shows the setup.



All tests were performed in the standard EasyWarePro software; data was directly taken from the reported values column of the tests.

3 Results

The Bland-Altman plot shows the results of bench testing:



The results can be summarized as follows:

- Mean value of all measurements deviates 0.47% from the target value.
- The sd over all measurements is 3.8%.
- The 95% confidence interval ranges from -6.9 to 7.4%.

90% of all measurements performed are within 5% ±18.9 ml (5% error plus the scale readout error caused by parallax, see [1], red dotted line in the plot above).

4 References

[1] Singer F, Houltz B, Latzin P, Robinson P, Gustafsson P. A Realistic Validation Study of a New Nitrogen Multiple-Breath Washout System. PLoS ONE 7(4): e36083.