

DLCO Zero Test

C. Buess, August 2025

1. Introduction

The standardization paper for DLCO measurements provided by ATS and ERS (*Eur Respir J* 2017; 49(1): 1600016) suggests three methods for equipment quality control:

- Equipment calibration
- DLCO test with a calibrated syringe, resulting in a DLCO value of zero:

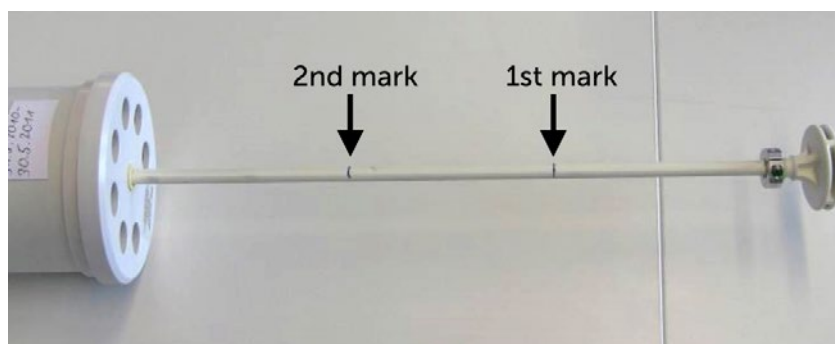
Secondly, a DLCO test should be performed with a calibrated 3-L syringe by attaching the syringe to the instrument in the normal patient test mode. The syringe should then be emptied, filled with 3 L of test gas and emptied into the mouthpiece after the 10 s breath-hold. The calculation of V_A must be within 300 mL of 3 L times the ATPD to BTPS (body temperature, ambient pressure, saturated with water vapour conditions) correction factor, which is $310/T_A \cdot P_B/(P_B - 47)$, where T_A is the ambient temperature in degrees kelvin and P_B is the barometric pressure in mmHg. It should be noted that a 3-L calibration syringe will have an additional dead-space which, depending on the connection to the mouthpiece, is typically ~50 mL and must be considered in the V_A calculation. The absolute value of the calculated DLCO must be $<0.166 \text{ mmol} \cdot \text{min}^{-1} \cdot \text{kPa}^{-1}$ or $<0.5 \text{ mL} \cdot \text{min}^{-1} \cdot \text{mmHg}^{-1}$.

- Biological control with a 'standard subject'.

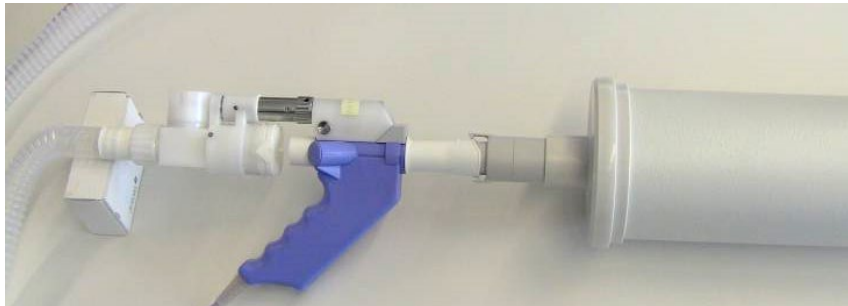
The first method is carried out automatically by the EasyOne Pro/LAB whenever a test is performed. The third method may be performed by technicians when required. This Application Note describes the second method using an EasyOne Pro/LAB.

2. Preparation

To perform the test, a calibrated 3-L to 5-L syringe is required. Divide the piston rod with two marks into three sections of approximately the same length (for a 3-L syringe, approx. 1 L for each section).



Attach the EasyOne Pro/LAB flow sensor tightly to the 3-L calibration syringe using the special ndd calibration adapter. Please make sure that the flow path is properly aligned and that the DLCO is attached to the flow sensor.



3. Test Procedure

In order to perform the test, please execute the following steps (the test procedure is also shown in the video [ZeroTest.mp4](#)):

1. Select a patient or enter a new patient.
2. Flush the syringe (see video [Flushing.mp4](#)).
3. Pulling the piston out of the syringe draws air into the syringe and thus simulates inhalation; pushing the piston into the syringe simulates exhalation. Pull the piston to the second mark; approx. 2 L of air are now inside the 3-L syringe.
4. On the EasyOne Pro/LAB, select *Perform Test* and then *DLCO*.
5. Confirm the measured ambient temperature, humidity, and pressure.
6. The DLCO test procedure starts. Wait until it is initialized.
7. Simulate a few breaths of tidal breathing around the 2nd mark (tidal breathing volume approx. $\frac{1}{2}$ L).
8. 'Exhale', i.e., push the syringe until it reaches the 1st mark. This way, approx. one third of the air inside the syringe is not 'exhaled', which simulates the residual volume of air inside the lungs.
Note: If the syringe is completely emptied, the zero-test is still valid. However, reserving one third of the air is recommended to test the device in a realistic measurement range.
9. Select *Activate* immediately.
10. 'Inhale' completely, i.e., pull the piston at medium flow speed until the syringe is full and the piston reaches the stop. Do not move the piston during the breath-hold time.
11. When the breath-hold time has elapsed and the valve opens, immediately 'exhale' the complete syringe volume at moderate speed (e.g., within 2 seconds). Then 'inhale' again to complete the test.
12. The EasyOne Pro/LAB stops the test automatically and computes the results.
13. The measured DLCO value should be <0.5 mL/min/mmHg (<0.166 mmol/min/kPa).

Remarks:

- Always flush the syringe between the test trials. Push the piston to the stop (no air inside the syringe), pull in about ½ L, and push again. Repeat this at least twice.
- Do not use the (already existing) patient called "Calibration Check" for this test.

4. References

Graham, B.L.; Brusasco, V.; Burgos, F.; Cooper, B.G.; Jensen, R.; Kendrick, A.; MacIntyre, N.R.; Thompson, B.R.; Wanger, J. 2017 ERS/ATS standards for single-breath carbon monoxide uptake in the lung. *Eur. Respir. J.* 2017, 49, 1600016, <https://doi.org/10.1183/13993003.00016-2016>.