

Technical Note: Leak rate for glovebox

INTRODUCTION

The leak tightness of standard MBRAUN inert gas systems is specified as class 1 according to ISO10648-2. The hourly leak rate for this class is defined to be $< 0.05 \text{ Vol\%/h}$. According to the ISO 10648-2 standard, the determination of the leak rate has to be done at a box internal pressure between -2.5 and -10 mbar with sealed glove ports. This means that a vendor who quotes a leak rate according to ISO10648-2 does not include the permeation through the gloves in the quoted values.

For an assumed box volume of 1 m^3 , a leak rate of 0.05 Vol\%/h allows a maximum leakage gas flow of 500 ml/h . With an ambient air Oxygen concentration of 20.9 Vol\% (i.e. approx. $20\% = 1/5$), this leads to a maximum of 100 ml/h of Oxygen, which may be transported into the internal atmosphere by the sum of all leaks. At 1 m^3 internal volume, this would lead to an increase of the Oxygen concentration of 100 ppm/h ($1 \text{ ml/m}^3 = 1 \text{ ppm}$)

Note: The estimated hourly increase of the Oxygen concentration is invariant to the box size. 1 m^3 is only taken for example to give an impression of the flow. It is also possible to convert 0.05 Vol\% directly to 500 ppm (air), resp. 100 ppm (Oxygen).

MEASUREMENT

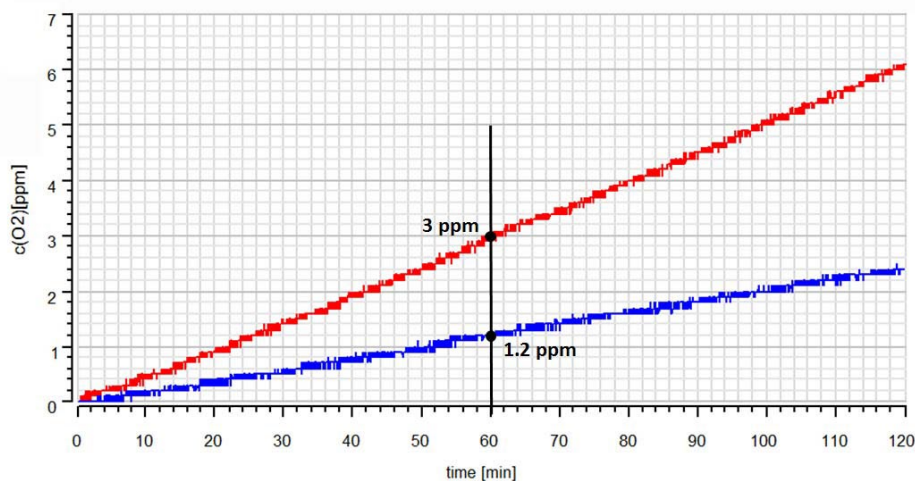


Fig1: Oxygen increase during leak test for Labstar at box internal pressure -10 mbar .

—: System with 2 gloves (Material: Butyl, thickness 0.4 mm , size 8,).

—: System with 2 glove ports sealed with inside covers.

CONCLUSION

With both glove ports sealed, there is an increase of only 1.2 ppm O_2 per hour, which results in an ISO leak rate of 0.0006 Vol\%/h . ($6 \cdot 10^{-4} \text{ Vol\%/h}$). Without glove port covers, the increase of the oxygen concentration is 3 ppm/h , resulting in a leak rate of 0.0015 Vol\%/h ($1.5 \cdot 10^{-3} \text{ Vol\%/h}$). This value now includes the permeation of oxygen from the ambient air through the gloves.

A comparison of these two values shows, that an increase of 1.8 ppm O_2 per hour of the total of 3 ppm/h is due to the permeation through the **two** gloves. This actually corresponds well with permeation data for the material of the gloves.

For a Labstar workstation with 2 gloves (material: Butyl), 60% (=1.8 ppm/h) of the total oxygen increase (3.0ppm/h) results from permeation of Oxygen through the gloves.

Glove box leak rate (with sealed glove ports): 1.2 ppm O₂/h (or 0.0006 Vol%/h)

Permeation rate through **one** glove: 0.9 ppm O₂ /h (or 0.00045 Vol%/h)

This proves that with the sealing technology used by M. Braun leak rates are obtained that are below the permeation rate through the glove. Statements by competitors, that by "proprietary" or even "patented" special glove box sealing technology very low leak rates for glove boxes can be obtained are therefore misleading, if not wrong, because in operation the permeation of Oxygen through the gloves is the predominate mechanism for oxygen increase in the glove box.