

Why are test lungs needed for ventilator testing?

In the US (and other countries) the number of days a patient is in the hospital is declining, however, the number of ventilator days has actually increased, both in intensive care units as well as in other settings, such as a patient's home. Aging populations in industrialized countries and epidemic events like SARS and AIDS contribute to this development. Knowing how the ventilators will perform is increasingly important.

Knowing what to expect from the ventilators and how each mode, in particular, will perform under real-world conditions, is a responsibility shared between respiratory caregivers and biomedical technicians. Ventilator design has improved significantly during the past decades and has removed sources of malfunction, however, new complexities arise from the heavy use of patient-triggered modalities and algorithms intended to adapt thresholds to particular care situations.

Accurate gas-flow analysis in combination with a precision test lung will allow complete evaluation of ventilator performance to both clinical expectations and manufacturer specifications. In addition, the ability of a test system (the combined accurate gas-flow analysis and precision test lung) to collect, store, and print the test results allows detailed information to be recorded in the same amount of time that pass/fail testing requires.

There are a variety of "test lungs" available and many do not fulfill the requirements necessary to be qualified as precision test lungs (see illustrations). Very few are labeled with a known compliance and/or resistance value. Some are capable of only one compliance/resistance setting, while others allow the user to adjust compliance and resistance independently for several different values. Even these adjustable test lungs may not be designed to provide the parameters used in national or international standards defining procedures for testing and calibration.



Michigan Instruments Test Lung



Restricted Test Lung



Breathing Bag



SMS Test Lung



AccuLung Test Lung

When documenting test results for respiratory caregivers to judge the ventilator performance, settings of compliance/resistance combinations must be known and reasonable accuracy of these settings assured. A calibration certificate for the test lung is, therefore, highly desirable. Likewise, if the test lung is not intended for use during testing and calibration of ventilators, that fact should also be called out in the product description or specifications. Ultimately, in order to confirm the proper function of all ventilator performance, aspects both to the ventilator manufacturer's specifications and to clinical expectation, a precision test lung with adjustable settings, coupled with a gas flow analyzer that allows for either computerized data collection or hard-copy printout of data, is needed.