UNIT EIGHT: OVERVIEW OF STANDARDS FOR SPIROMETRIC EQUIPMENT

When purchasing spirometric equipment, check that the manufacturer's specifications meet current ATS standards. These standards are summarized below. Unless otherwise noted, the Cotton Dust Standard equipment requirements are the same. (See **Appendix E: OSHA Cotton Dust Standard, Appendix D. and Appendix F: American Thoracic Society Standards**, for copies of these standards.)

1. Volume
   The spirometer must be capable of measuring volumes of at least 8 liters (BTPS) with flows between zero and 14 L/s. It must also be able to accumulate volume for at least 15 seconds **(10 seconds for Cotton Dust Standard)**.

2. Inertia and Resistance
   There must be less than 1.5 cm H_2O/liter/second at an air flow of 12 liters/second. (Read the manufacturer's specifications to check this.)

3. Zero Time Determination.
   The spirometer must have a recording chart that is activated before the forced expiratory maneuver begins in order to calculate zero time. For computerized systems, the start of the test must be determined by back extrapolation for timing purposes. **(Cotton Dust Standard: zero time is determined by back extrapolation or an equivalent method.)**

4. Conversion to BTPS
   The instrument and/or the user must have a means for converting values to BTPS.

5. Accuracy.
   a. The equipment must be capable of being calibrated in the field.

   b. The FVC and the FEV_1 must be measured with an accuracy within $\pm$3% or $\pm$50ml, whichever is greater.

   c. The volume calibration check must show an accuracy of within $\pm$3% or $\pm$50ml, whichever is greater.

   d. If the $FEF_{25-75\%}$ is used, it must be measured with an accuracy of at least $\pm$5% or 200ml/s, whichever is greater. It should be measured on equipment that meets ATS standards for the FVC. **(Cotton Dust Standard: The $FEF_{25-75\%}$ is not required.)**

   e. Flow measurements must be accurate to within $\pm$5% or 200ml/s, whichever is greater. **(Cotton Dust Standard: No information is given.)**

6. Spirometry Recorder/Displays.
   Paper records or graphic displays are required.
   a. Recorders must have the capability of recording volume vs. time or flow vs. volume during the entire forced expiratory maneuver. **(Cotton Dust Standard: The tracing must be stored and available for recall and must be of sufficient size that hand measurements may be made.)**

   b. The paper must move at a chart speed of at least 20mm/sec.

   c. Recorders must trace flow/volume curves with exhaled flow on the vertical axis and exhaled volume on the horizontal axis, going from left to right. **(Cotton Dust Standard: It allows only tracings of the size used for validation and measurement by hand.)**

   d. The volume scale should be at least 10mm/L (BTPS), the flow scale should be 5mm **(4mm for Cotton Dust Standard)** of chart paper per liter per second of flow, and the time scale at least 2cm/s (although 3cm/s is preferred).

      (According to ATS, using tracings for doing calculations by hand allows for determining spirometric values "in the absence or failure of a computer (10)." Tracings for validation "validate the spirometer system hardware and software for accuracy and reliability through the use of hand measurements..." (10). [However, as was pointed out in **Unit Two: Overview of Spirometry**, electronically produced spirograms are reconstructed instead of mechanically produced and therefore will always correspond to the printout. As a result, hand calculations provide only a limited way to check that this type of system is working properly.])