LUNG VOLUMES AND CAPACITIES

Static lung volume and capacities

Static lung volumes are determined using methods in which airflow velocity does not play a role.

The sum of two or more lung-volume subdivisions constitutes a lung capacity.

The subdivisions and capacities are expressed in liters at body temperature and pressure saturated with water vapor (BTPS).

Static lung volumes and capacities

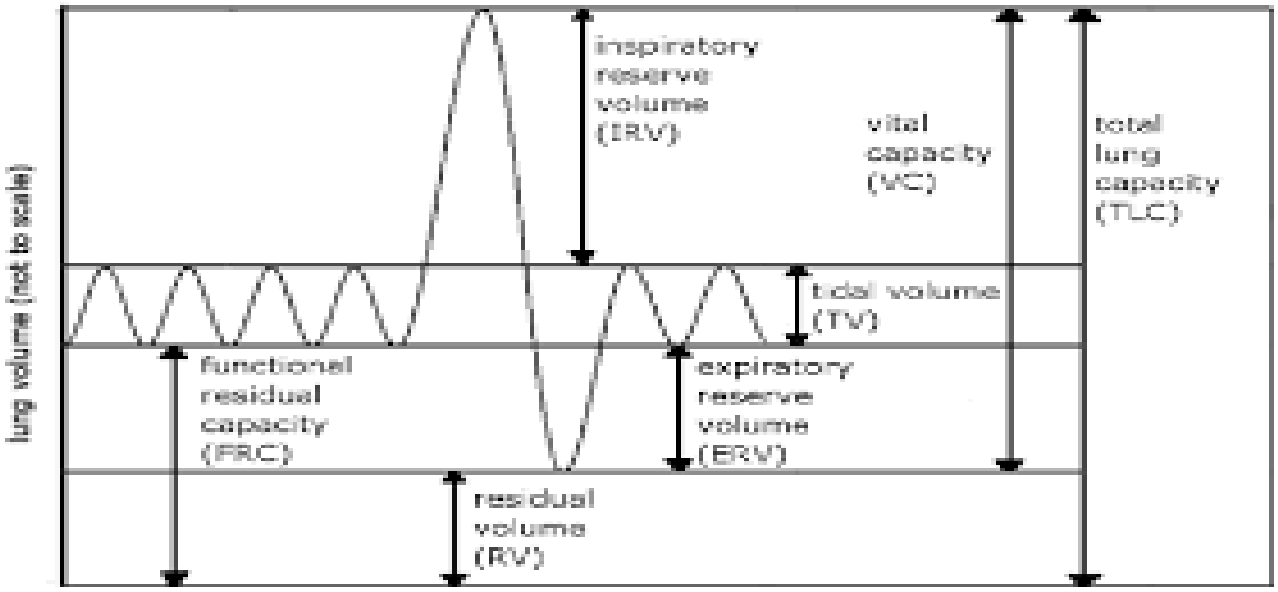
Tidal Volume	TV	The volume of air inhaled & exhaled at each breath during normal quiet breathing
Inspiratory Reserve Volume	IRV	The volume of air that can be forcefully inspired following a normal quiet inspiration
Expiratory Reserve Volume	ERV	The volume of air that can be forcefully expired after a normal or resting expiration
Vital Capacity	VC	The maximum amount of air that can be exhaled after the fullest inspiration possible (TV + ERV + IRV)
Inspiratory Capacity	IC	The maximum amount of air that can be inhaled after a normal exhalation (TV + IRV)
Residual Volume	RV	The volume of air remaining in the lungs after a forceful expiration
Total Lung Capacity	TLC	The total volume of the lungs (VC + RV)
Functional Residual Capacity	FRC	The amount of air remaining in the lungs after a normal quiet expiration (ERV + RV)

The following terms describe the various lung volumes:

- The **tidal volume (TV),** about 500 mL, is the amount of air inspired during normal, relaxed breathing.
- The **inspiratory reserve volume (IRV),** is the additional air that can be forcibly inhaled after the inspiration of a normal tidal volume.
- The **expiratory reserve volume (ERV),** is the additional air that can be forcibly exhaled after the expiration of a normal tidal volume.
- **Residual volume (RV),** is the volume of air still remaining in the lungs after the expiratory reserve volume is exhaled.

Summing specific lung volumes produces the following lung capacities:

- The **total lung capacity (TLC),** about 6,000 mL, is the maximum amount of air that can fill the lungs (TLC = TV + IRV + ERV + RV).
- The **vital capacity (VC),** about 4,800 mL, is the total amount of air that can be expired after fully inhaling (VC = TV + IRV + ERV = approximately 80 percent TLC). The value varies according to age and body size.
- The **inspiratory capacity (IC),** about 3,600 mL, is the maximum amount of air that can be inspired (IC = TV + IRV).
- The **functional residual capacity (FRC),** about 2,400 mL, is the amount of air remaining in the lungs after a normal expiration (FRC = RV + ERV).



Dynamic lung volume and capacities

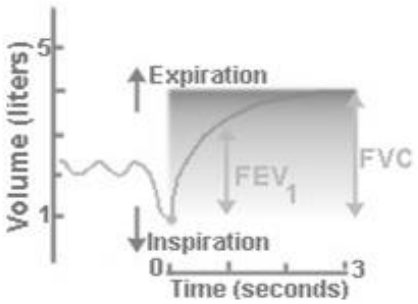
Dynamic Lung Volumes

Forced Vital Capacity	FVC	The total volume expired by a forced maximal expiraion from a position of maximal inhalation
Forced Expiratory Volume in 1 sec	$FEV_{1.0}$	The volume of air expired in the first second of maximal forced expiration from a position of full inspiration
Forced Expiratory Flow from 25-75% of exhalation	FEF_{25-75}	The average flow rate during the middle 50% of the forced vital capacity maneuver.

or Maximum Mid-expiratory Flow (MMEF)

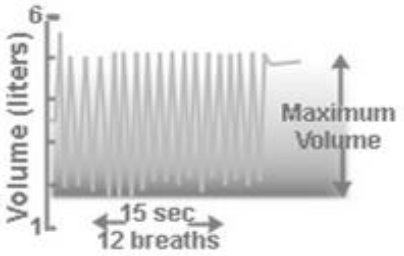
Lung volumes that depend upon the rate at which air flows out of the lungs are termed dynamic lung volumes. There are various dynamic tests: **Forced Vital Capacity** test, and the **Maximum Voluntary Ventilation** test.

The **Forced Vital Capacity (FVC)** is the volume of gas that can be exhaled as forcefully and rapidly as possible after a maximal inspiration. Normally FVC = VC, however in certain pulmonary diseases (characterized by increased airway resistance), FVC is reduced.



From the FVC test, we can also determine the Forced Expiratory Volume in 1 sec (FEV_1), which is the maximum volume of air that can be exhaled in a 1 sec time period. Normally the percentage of the FVC that can be exhaled during 1 sec is around 80% (i.e. $FEV_1/FVC=80\%$).

Maximum Voluntary Ventilation (MVV) is the largest volume of air that can be breathed in and out of the lungs in 1 minute. It will be reduced in pulmonary diseases due to increases in airway resistance or changes in compliance.



MVV = **Maximum volume x rate/minute**