

ATS/ERS Pulmonary Function Acceptability & Repeatability Guidelines

Forced Vital Capacity



ACCEPTABILITY

1. Back extrapolated volume must be $<5\%$ of the FVC or 0.150 L, whichever is greater.
2. The volume/time curve shows no change in volume for ≥ 1 second (*subject has a plateau*).
3. For subjects 7-9 years old, the subject has tried to exhale for ≥ 3 seconds OR for subjects ≥ 10 years old, the subject has tried to exhale for ≥ 6 seconds (>15 seconds rarely changes clinical decisions).
4. There should be no cough detected in the first second of exhalation which could affect FEV₁.
5. There should be no leaks, Valsalva maneuver (*glottis closure*) or obstruction of mouthpiece
6. An adequate test requires a minimum of three acceptable FVC maneuvers with two of them meeting repeatability criteria.

ACCEPTABILITY PRESCHOOL CHILDREN (≤ 6 YEARS OLD)

1. Back extrapolated volume of <80 mL or 12.5%
2. Cessation of flow occurs at 10% or less of Peak Flow.
3. Expiratory time should be reported but not used to exclude maneuvers.
4. At least two acceptable maneuvers.

REPEATABILITY

1. The difference between the largest and next largest FVC is ≤ 0.150 L.
2. The difference between the largest and next largest FEV₁ is ≤ 0.150 L.
3. If FVC is ≤ 1.0 L, these values are reduced from 0.150 L to 0.100 L.
5. The largest values for FVC, FEV₁ and Peak Flow, from three acceptable maneuvers are reported.

REPEATABILITY PRESCHOOL CHILDREN (≤ 6 YEARS OLD)

1. The difference between the largest and next largest FVC is ≤ 0.1 L.
2. The difference between the largest and next largest FEV₁ is ≤ 0.1 L.

BRONCHODILATOR RESPONSE

1. Efforts can be recorded ≥ 10 minutes and up to 15 minutes after giving short-acting B₂-agonists, and 30 minutes after giving short-acting anticholinergic agents.
2. A $>12\%$ and 200 mL change in FEV₁ compared to baseline suggests a "significant" bronchodilatation OR a $>12\%$ and 200 mL change in FVC compared to baseline suggests a "significant" bronchodilatation.

Diffusing Capacity



ACCEPTABILITY

1. Inspired volume should be $\geq 90\%$ of largest Vital Capacity*.
2. 85% of test gas inhaled in <4 seconds.
3. Breath Hold Time should be between 8-12 seconds.
4. Sample collection should be completed within 4 seconds of the start of exhalation. For RGA systems, virtual sample collection should be initiated after dead-space washout is complete.
5. No evidence of leaks, or Valsalva or Mueller maneuvers during lockout.
6. At least 4 minutes between tests to allow an adequate elimination of test gas from the lungs for classical systems. For RGA systems, tracer gas level at end-exhalation must be $\leq 2\%$ of the tracer gas concentration in the test gas.

REPEATABILITY

1. DLco values should be within 2 mL/min/mmHg (0.67 mmol/min/kPa) of each other.
2. The average of at least two acceptable tests that meet repeatability should be reported.

NOTE: Adjustments of DLco for Hb, COHB and altitude should be considered.

*A maneuver with an inspired volume of $\geq 85\%$ of largest vital capacity may be deemed acceptable if the VA is within 200mL or 5% (whichever is greater) of the largest VA from other acceptable maneuvers.

TGV/FRC_{PLETH}



ACCEPTABILITY

1. Closed shutter panting frequency between 0.5 and 1.0 Hz (30-60/min).
2. Patient's cheeks are to be supported by both hands and the subject should breathe quietly until a stable end-expiratory level is achieved (usually 3-10 tidal breaths) before closing the shutter.
3. A series of 3-5 technically satisfactory panting maneuvers should be recorded.

NOTE: It is recommended to perform an SVC immediately after the shutter reopens in order to accurately calculate Total Lung Capacity.

REPEATABILITY

1. At least three TGV (FRC_{pleth}) values that agree within 5% (the difference between the highest and lowest value divided by the mean).
2. The average value should be reported.

Nitrogen Washout



ACCEPTABILITY

1. N₂ concentration should be $<1.5\%$ for at least three successive breaths before ending test.
2. A change in inspired N₂ of $>1\%$ or sudden large increases in expiratory N₂ concentrations may indicate a leak.
3. At least one technically satisfactory measurement should be obtained.

REPEATABILITY

1. If more than one measurement of FRCN₂ is made, the value reported should be the average of technically acceptable results that agree within 10%.

NOTE: If more than one washout is performed, a waiting period of ≥ 15 minutes is recommended between trials. Patients with severe COPD should wait ≥ 1 hour between trials.

For additional information on pulmonary diagnostics, please consult the ATS/ERS guidelines:

www.thoracic.org ||| www.ers-education.org

references:

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ATS/ERS Task Force: Standardisation of spirometry, Eur Respir J 2005; 26: 319-338
ATS/ERS Standards for Single-Breath Carbon Monoxide Uptake in the Lung, Eur Respir J 2017; 49: 1600016
ATS/ERS Statement: Pulmonary Function Testing in Preschool Children, AM J Respir Crit Care Med; Vol 175: 1304-1345, 2007

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through its subsidiary Medical Graphics Corporation

350 Oak Grove Parkway
St. Paul, Minnesota USA 55127-8599

www.mgcdiagnostics.com

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