Guidelines for VA Pulmonary Function Test (PFT)

Instructions for performing and documenting PFT (pulmonary function test)

A chest x-ray and pulmonary function test (PFT) must be reported for all examinees claiming respiratory conditions. Spirometry technicians play a critical role in obtaining accurate and precise results. They frequently have primary responsibility for seeing that quality assurance measures are carried out; selecting, preparing, and coaching examinees; and determining whether results are **acceptable** and **reproducible**. Therefore it is essential that these individuals receive comprehensive training in these areas.

It is essential for a proper measurement of FVC and FEV1 that the examinee delivers a **maximum performance**. On that account the examinee needs to be properly instructed prior to the test, needs to be continuously and loudly encouraged while performing the maneuvers. Improperly performed tests leads to artificially low values of FVC and FEV1 and may give rise to erroneous interpretations. It is also vital to comment on the examinee's effort during the PFT.

The following guidelines must be adhered to when conducting and reporting on the pulmonary function test:

- Test should not be performed during or soon after acute respiratory illness or if medically contraindicated.
- Expired volumes must be expressed in liters BTPS.
- There must be **at least 3** satisfactory forced expiratory maneuvers pre-bronchodilator.
- **Two of the satisfactory expiratory maneuvers** should be **reproducible**, i.e., Do not differ from the largest value by more than 5% or 0.1 L, whichever is greater.
- Peak Flow must be achieved early in expiration.
- Spirogram must have a smooth contour with gradually decreasing flow throughout expiration.
- Zero time measurement of the FVC and FEV1, if not distinct, should be derived from linear back-extrapolation of peak flow to zero volume. Spirogram is satisfactory for measurement of FEV1 if the expiratory volume at the back-extrapolated zero time is less than 5% of the FVC or 0.1 L, whichever is greater.
  Spirogram is satisfactory for measurement of the FVC if maximal expiratory effort continues for at least 6 seconds, or if there is a plateau in the volume-time curve with no detectable change in the expired volume during the last 2 seconds of maximal expiratory effort.

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Contraindications:
The following are the only acceptable medical contraindications for not conducting PFT:

- When the results of a maximum exercise capacity test are of record and are 20 ml/kg/min or less.
- When pulmonary hypertension (documented by an echocardiogram or cardiac catheterization), cor pulmonale, or right ventricular hypertrophy has been diagnosed.
- When there have been one or more episodes of acute respiratory failure.
- When outpatient oxygen therapy is required.

For VA Rating purposes, age alone is NOT an acceptable factor for PFT deferral. Because of spirometry equipment limitations for examinees 79 and older, a manual calculation must be done to determine the predicted values. However, the usual spirometry must still be performed, regardless of age. The manually calculated values (instead of the predicted values from spirometry) are then used in conjunction with actual spirometry values to determine the % predicted for FVC and FEV-1.

MANEUVER QUALITY CHECKS

Medical assistants/technicians must vigorously coach each examinee in performing acceptable maneuvers, and recognize the various patterns of poorly performed maneuvers.

a. A slow start (poor blast effort) can cause falsely low FEV1 values.
b. Failure to fully inhale before the maneuver or exhale during the test can cause falsely low FVC values.
c. Test sessions in which the highest minus second highest FEV1s (or FVCs) don't match within 200ml indicate poor reproducibility of the FEV1 or FVC within a test session is an indication that effort was sub maximal.
d. The repeatability of the FEV1 and FVC, and the quality of all test sessions should be checked manually.

CALIBRATION

Disability testing requires that calibration be done at three flow rates: one (1), three (3), and six (6) seconds. It will also require that the calibration error at these flow rates be within +/- 1%. The type of Sensor Flow that is used for the disability calibrations check must be used for the disability testing.

- Spirometric tracing must show a recorded calibration of volume units using a mechanical volume input, such as a 3 L syringe, unless the tracing is generated by direct pen-linkage to a mechanical displacement-type spirometer.

- If the Spirometer directly measures flow, and volume is derived by electronic integration, the linearity of the device must be documented by recording volume calibrations at 3 different flow rates: (3L16 SEC), (3L/3 SEC), (3L/SEC)
- Volume calibrations should agree to within 1% of a 3 L calibrating syringe volume. If accuracy is less than 1% but within 3% of the calibrating syringe- use the following formula:
    - Volume correction factor actual syringe volume/measured volume.
    - The measured FVC and FEV1 should be multiplied by the calibration correction factor. If the FVC and FEV 1 tracings are at ATPS, the values should in turn be multiplied by the BTPS factor. When the measured FVC and FEV1 are at BTPS, the BTPS correction factor should not be applied.
- Proximity of the flow sensor to the individual should be noted.
- It should be noted whether a BTPS correction factor was used for the calibration recordings and for the actual test.

TRACINGS

- Provide tracings of all three FVC attempts, pre and post bronchodilator.
- Must be appropriately labeled, showing examinee's name, date of testing, distance per second on the abscissa, and distance per liter on the ordinate.
- Must have a time scale of at least 20 mm/sec.
- Must have volume scale of at least 10 mm/L.
  NOTE: Calculation of FEV1 from a flow-volume tracing is not acceptable**.**

POSTBRONCHODILATOR

- Post-bronchodilator studies should be done **if any of the following prebronchodilator results are less than 81%**, unless medically contraindicated:
    - FVC % Predicted
    - FEV-1 % Predicted
    - FEV-1/FVC ratio (**BEST** Column)
- Include dose and name of bronchodilator administered in the report.
- Post-bronchodilator testing should be done 10 minutes after administration of the bronchodilator.

OTHER REPORTING INFORMATION

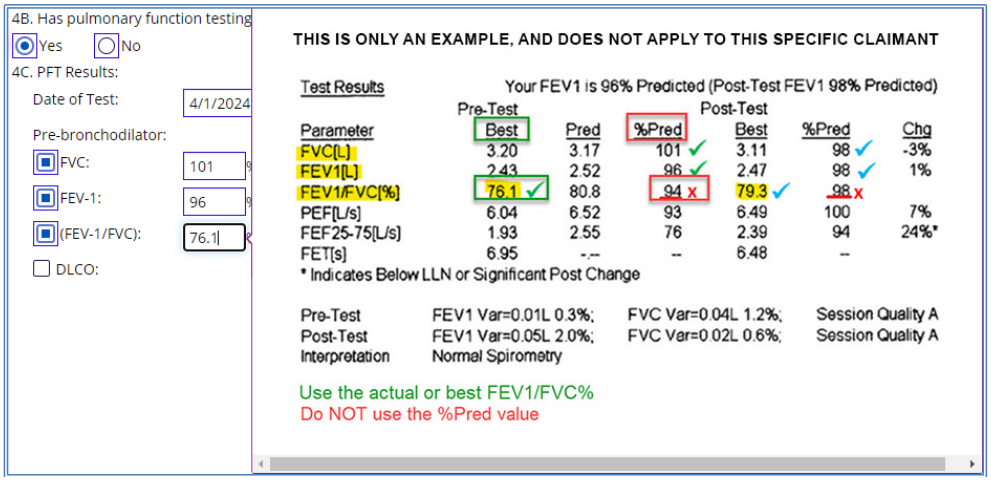
- Manufacturer and model number of device used to measure and record the spirogram should be stated.
- Statement regarding the individual's ability to understand directions, as well as effort and cooperation, should be included.
- If a bronchodilator is not administered, indicate the reason why.
- Height of the individual, without shoes, must be recorded.

DOCUMENTATION

The PFT should be clearly reported with pre-bronchodilator results. When the pre-bronchodilator FVC % predicted , FEV1 % predicted OR the flow rate FEV-1/FVC (BEST) are **greater than or equal to 81%** this is considered normal and a post-bronchodilator is not needed. If contraindicated, state so in your report.

Post bronchodilator is NOT required to be performed when **ALL of these parameters are greater than or equal to 81%,** no rounding +/- on values:
- FEV1 % predicted value
- FVC % predicted value
- Flow rate (FEV1/FVC)

In section 4C of the Respiratory DBQ, the VA expects the following values to be cited:
- FVC: % predicted
- FEV-1: % predicted
- FEV-1/FVC: % - This represents the flow rate. DO NOT report FEV-1/FVC % predicted



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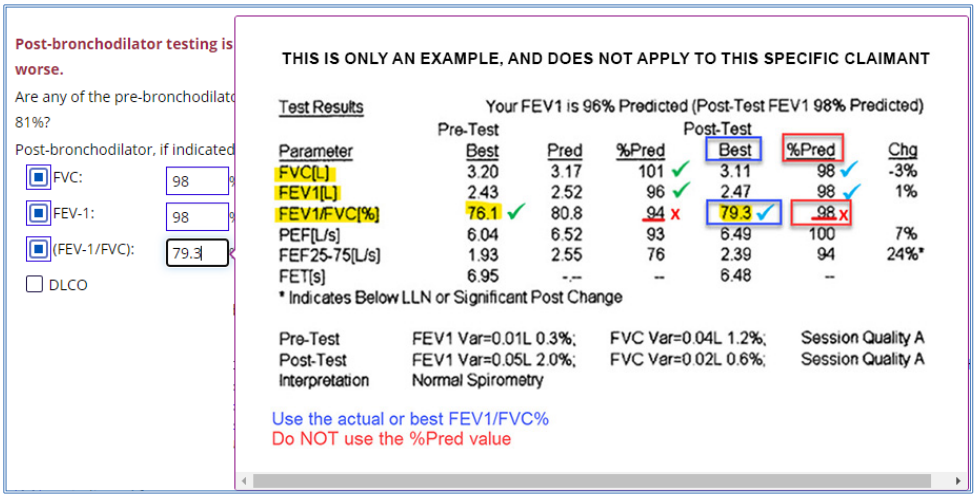

Post-bronchodilator testing is
worse.
Are any of the pre-bronchodilat
81%?
Post-bronchodilator, if indicated
FVC: 98
FEV-1: 98
(FEV-1/FVC): 79.3
DLCO

THIS IS ONLY AN EXAMPLE, AND DOES NOT APPLY TO THIS SPECIFIC CLAIMANT

Test Results — Your FEV1 is 96% Predicted (Post-Test FEV1 98% Predicted)

Parameter	Pre-Test Best	Pred	%Pred	Post-Test Best	%Pred	Chg
FVC[L]	3.20	3.17	101 ✓	3.11	98 ✓	-3%
FEV1[L]	2.43	2.52	96 ✓	2.47	98 ✓	1%
FEV1/FVC[%]	76.1 ✓	80.8	94 x	79.3 ✓	98 x	
PEF[L/s]	6.04	6.52	93	6.49	100	7%
FEF25-75[L/s]	1.93	2.55	76	2.39	94	24%*
FET[s]	6.95	-.--	--	6.48	--	

* Indicates Below LLN or Significant Post Change

Pre-Test	FEV1 Var=0.01L 0.3%;	FVC Var=0.04L 1.2%;	Session Quality A
Post-Test	FEV1 Var=0.05L 2.0%;	FVC Var=0.02L 0.6%;	Session Quality A
Interpretation	Normal Spirometry		

Use the actual or best FEV1/FVC%
Do NOT use the %Pred value

The FVC % predicted and the FEV-1 % predicted are taken directly from the % Pred column on the PFT diagnostic. However the FEV-1/FVC is not taken from the % Pred column. Instead, the FEV-1/FVC is obtained by taking the **best** actual measured value of FEV-1 divided by the actual measured value of FVC.

These values are typically listed under Pre- Test or Post-Test **BEST** column.

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The results of the PFT test should be consistent with the examinee's medical history, physical examination, x-ray results and daily activities. If not, comment in your report why the results are inconsistent. Also document the degree of effort and cooperation exhibited by the examinee during the PFT test. If DLCO is recommended, please state so. Do NOT perform additional testing without Leidos QTC approval.

SPIROGRAMS

There are two types of spirograms: Volume/Time and Flow/Volume tracings

Volume/Time Curve:

- Tracings record volume in relation to time
- The 'y' (vertical) axis plots volume of air exhaled during the maneuver is measured in liters and the 'x' (horizontal) axis plots time in seconds

Good start: the quick rise from zero indicates that the examinee exhaled hard and fast without hesitating, as the examinee continues to exhale, the curve levels off to a plateau. The leveling off the curves indicates that the volume is no longer increased. This means that the examinee has given a full expiration.

End of test: Notice how long the examinee was able to exhale by looking at the time axis. Six (6) seconds is the recommended duration of the maneuver. Stopping before the curve plateau is unacceptable and is called as "early termination."

Volume/Time Curve is a good place to see:

a. How long the examinee exhaled and whether they accomplished a full expiration - Time axis
b. How much air they exhaled and how much air was exhaled during the 1st second of the maneuver – Volume axis

Flow/Volume Curve:

- Tracings measure air flow in relation to volume in liters
- The 'y' (vertical) axis plots the rate of air flow in liters per second and the 'x' (horizontal) axis plots volume in liters

Flow/Volume is a good place to see:

a. Easier to recognize the patterns of slow or hesitant starts
b. It is very easy to detect a cough because the flow drops to zero with no air flow when the glottis closes
c. Good peak – examinee gave a good effort
d. The indistinct peak can indicate that the examinee gave a poor effort, often follows a slow of hesitating start
e. An early termination can be identified by an abrupt drop in flow

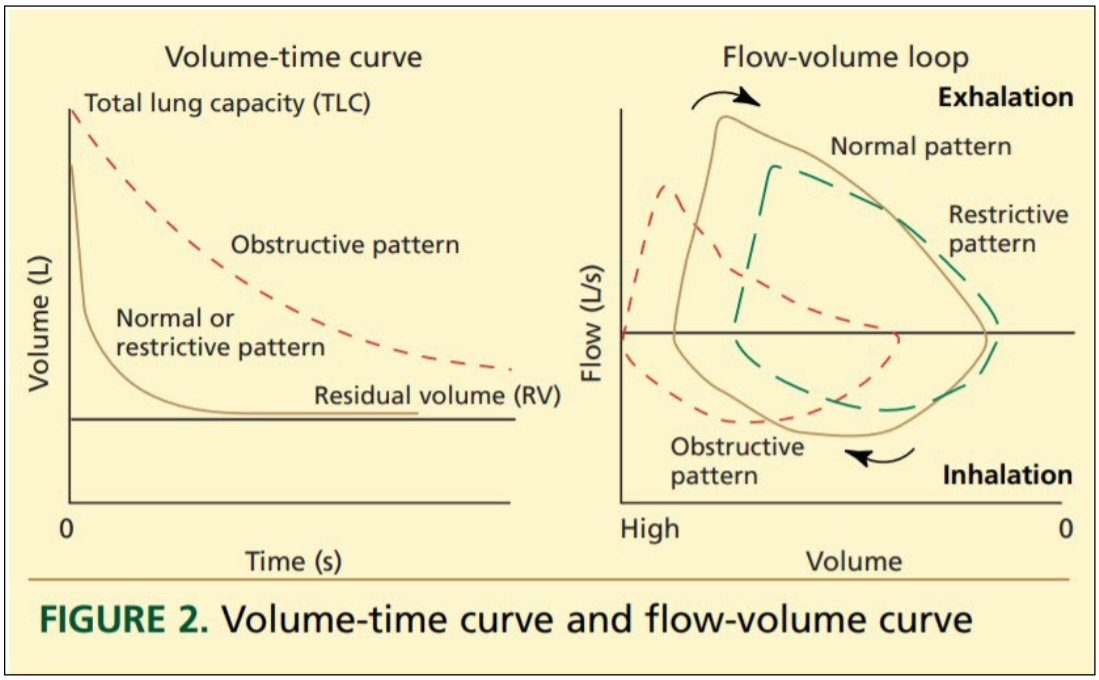

FIGURE 2. Volume-time curve and flow-volume curve

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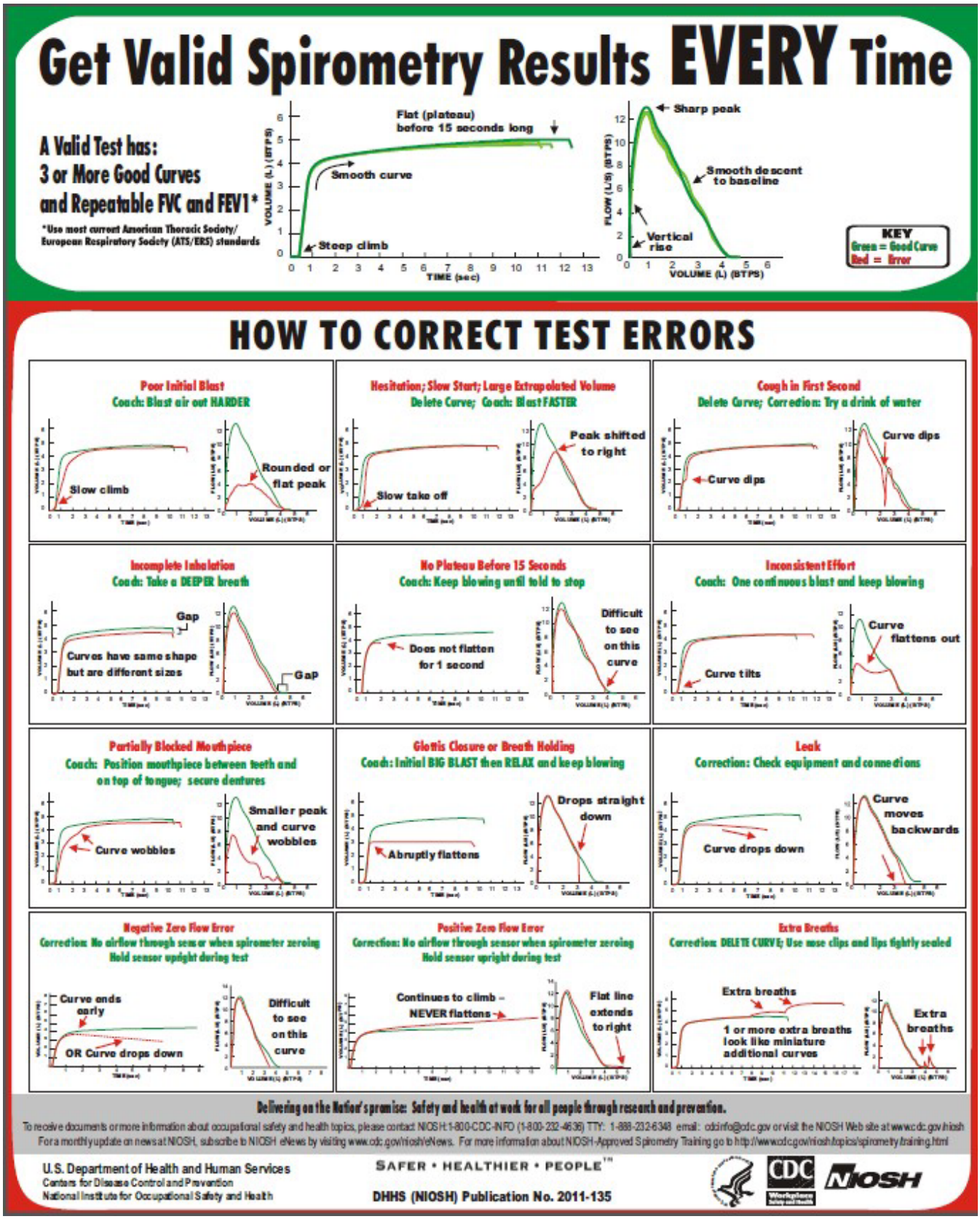
Key PFT terms:

Acceptable	• Defined as free from error
Reproducible	• Defined as being without excessive variability
Spirometry	• A test to measure how much (volume) air and how fast (flow) you can move into and out of your lungs
Forced Vital Capacity (FVC)	• Total amount of air that can be blown out after a maximum deep breath, as fast as possible • The normal range is 80-120% predicted
Forced Expired Volume in one second (FEV1)	• The amount of air that can be blown in the first second in the FVC exercise • The normal range is 80-120% predicted
Flow Rate – FEV1/FVC (also referred to as the ratio)	• Forced expiratory volume (FEV1) in one second expressed as a percentage of the forced vital capacity (FVC)
Spirograms	• Tracings or recordings of the information obtained from the test
Diffusing capacity of the lung (DLCO)	• The capacity of the lungs to transfer carbon monoxide (mL/min/mm Hg) • Measures the ability of the lungs to transfer gas from inhaled air to the red blood cells in pulmonary capillaries • Requires ten seconds of breatholding instead of the forced exhalation required for spirometry


Get Valid Spirometry Results EVERY Time
A Valid Test has:
3 or More Good Curves
and Repeatable FVC and FEV1*
*Use most current American Thoracic Society/ European Respiratory Society (ATS/ERS) standards
Flat (plateau) before 15 seconds long
Smooth curve
Steep climb
VOLUME (L) (BTPS)
TIME (sec)
Sharp peak
Smooth descent to baseline
Vertical rise
FLOW (L/S) (BTPS)
VOLUME (L) (BTPS)
KEY
Green = Good Curve
Red = Error
HOW TO CORRECT TEST ERRORS
Poor Initial Blast
Coach: Blast air out HARDER
Slow climb
Rounded or flat peak
Hesitation; Slow Start; Large Extrapolated Volume
Delete Curve; Coach: Blast FASTER
Slow take off
Peak shifted to right
Cough in First Second
Delete Curve; Correction: Try a drink of water
Curve dips
Curve dips
Incomplete Inhalation
Coach: Take a DEEPER breath
Curves have same shape but are different sizes
Gap
Gap
No Plateau Before 15 Seconds
Coach: Keep blowing until told to stop
Does not flatten for 1 second
Difficult to see on this curve
Inconsistent Effort
Coach: One continuous blast and keep blowing
Curve tilts
Curve flattens out
Partially Blocked Mouthpiece
Coach: Position mouthpiece between teeth and on top of tongue; secure dentures
Curve wobbles
Smaller peak and curve wobbles
Glottis Closure or Breath Holding
Coach: Initial BIG BLAST then RELAX and keep blowing
Abruptly flattens
Drops straight down
Leak
Correction: Check equipment and connections
Curve drops down
Curve moves backwards
Negative Zero Flow Error
Correction: No airflow through sensor when spirometer zeroing
Hold sensor upright during test
Curve ends early
OR Curve drops down
Difficult to see on this curve
Positive Zero Flow Error
Correction: No airflow through sensor when spirometer zeroing
Hold sensor upright during test
Continues to climb – NEVER flattens
Flat line extends to right
Extra Breaths
Correction: DELETE CURVE; Use nose clips and lips tightly sealed
Extra breaths
1 or more extra breaths look like miniature additional curves
Extra breaths
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