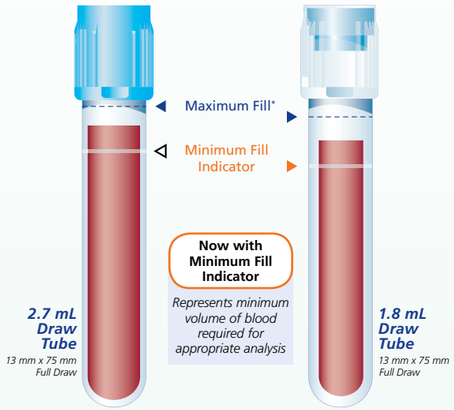


The BD Plastic Citrate tubes are designed with a minimum fill indicator etched into the tube. This indicator represents the minimum volume of blood required for appropriate analysis.

Please visit our website to view the BD Vacutainer® Plus Plastic Citrate Tube Draw Volume Guide, which provides the minimum, nominal and maximum fill indicators:

http://www.bd.com/vacutainer/pdfs/plus_plastic_tubes_instructions_drawvolguide_VS5944-1.pdf

REVIEW OF BLOOD COLLECTION TUBE DRAW VOLUME OPTIONS:

BD Diagnostics – Preanalytical Systems offer an array of blood collection tubes. Recent advances in instrument technology and the use of smaller draw volume collection tubes allows most laboratories to decrease collection volumes without compromising their ability to report reliable and timely results.

Please visit our website to review the BD Product Catalog at **www.bd.com/vacutainer** to select the appropriate draw volume for your facility, or contact your local Sales Consultant.

References:

1. Errors in Laboratory Medicine. Bonini P., Plebani M., *Clin Chem* 2002: 48(5): 691-698.
2. BD Vacutainer® Evacuated Blood Collection System product insert available from www.bd.com/vacutainer/productinserts.
3. Heparin interferes with the radioenzymatic and homogeneous enzyme immunoassays for aminoassays for aminoglycosides. Krogstad DJ, Granich GG, Murray PR, Pfaller MA and Valdes R. *Clin Chem 1982; 28(7): 1517-1521.*
4. *K2- or K3-EDTA: The anticoagulant of choice in routine haematology. Goossens W, Van Duppen V* and *Verwilghen RL. Clin Lab Haemat. 1991; 13: 291-295*
5. *Pseudopolycythemia, pseudothrombocytopenia, and pseudoleukopenia due to overfilling of blood collection vacuum tubes. Pewarchuk W, Vanderboom J* and *Blajchman MA. Arch Pathol Lab Med. 1992; 116: 90-92.*
6. *Minimum specimen volume requirements for routine coagulation testing: dependence on citrate concentration. Adcock DM, Kressin DC* and *Marlar RA. AJCP. 1998; 109(5): 595-599.*
7. College of American Pathologists Commission on Laboratory Accreditation Laboratory General Checklist, Question GEN.40500 (2009).
8. *Risk management in the preanalytical phase of laboratory testing. Lippi G* and *Guidi GC. Clin Chem Lab Med. 2007; 45(6): 720-727.*
9. *Specimen collection volume for laboratory tests. Dale JC* and *Ruby SG. Arch Pathol Lab Med 2003; 127: 162-168.*
10. *Recommendations for detection and management of unsuitable samples in clinical laboratories. Lippi G, Banfi G, Buttarello M, et al. Clin Chem Lab Med. 2007; 45(6): 728-736.*
11. *Effect of sample aliquot size on the limit of detection and reproducibility of clinical assays. Chen G, Kobayashi L* and *Nazarenko I. Clin Chem 2007; 53(11): 1962-1965.*
12. *Laboratory network of excellence: enhancing patient safety and service effectiveness. Plebani M, Ceriotti F, Messeri G, et al. Clin Chem Lab Med. 2006; 44(2): 150-160.*
13. *CLSI (formerly NCCLS) document H1-A6. Tubes and Additives for Venous and Capillary Blood Specimen Collection; Approved Standard – Sixth Edition. Clinical and Laboratory Standards Institute, 940 West Valley Road, Suite 1400, Wayne, Pennsylvania 19087-1898 USA, 2003.*
14. BD Vacutainer® Safety-Lok™ and BD Vacutainer® Push Button Blood Collection Set product inserts are available from www.bd.com/vacutainer/productinserts.
15. *Lippi G, Salvagno GL, Montagnana M, Franchini M* and *Guidi GC. Clin Lab. 2006; 52: 217-230.*

Please call BD Global Technical Services for clinical support material.

BD Global Technical Services: 1.800.631.0174

BD Customer Service: 1.888.237.2762

05/11 VS9016

BD Diagnostics
Preanalytical Systems
1 Becton Drive
Franklin Lakes, NJ 07417
www.bd.com/vacutainer

Tech Talk®

Volume 10, No. 2 July 2011

Author: Lena Arzoumanian

BD Global Technical Services receives many questions about BD products. To address these questions, we have developed a periodic news bulletin called "Tech Talk®."

Q. What is the acceptable minimum draw volume for BD Vacutainer® Tubes?

A. A common reason for specimen rejection and redraw is insufficient blood draw volume.[1]

The blood collection tubes contain specific quantities and types of additives. The tubes are designed to collect a predetermined quantity of blood in order to achieve a defined concentration of additive in the blood sample, that is, a correct blood-to-additive ratio.

An incorrect blood-to-additive ratio may lead to inaccurate test results.[2]

- **Too high a final concentration of the additive due to under filled tubes may result in preanalytical errors such as:**
  - Hemolyzed sample with tubes containing glycolytic inhibitors[3]
  - Changes in cell morphology with tubes containing K_2EDTA[4]
  - Prolonged coagulation times with tubes containing sodium citrate[5]
- **Too low a final concentration of the additive due to overfilled tube may result in:**
  - Delayed clotting or fibrin formation in serum tubes[6]
  - Inadequate anticoagulation resulting in platelet clumping and clotting in whole blood tubes and/or creation of micro clots in plasma, which can affect instrument performance

BD recommends filling the tubes to the stated draw volume as indicated on the label of the tube. They are designed to maintain the blood-to-additive ratio throughout the shelf life of the tube.

When using a winged blood collection set for venipuncture, and a coagulation (citrate) tube is the first specimen tube to be drawn, a discard tube should be drawn first. The discard tube must be used to fill the blood collection set tubing's "dead space" with blood but the discard tube does not need to be completely filled. This important step will ensure proper blood-to-additive ratio. The discard tube should be a non-additive or coagulation tube.

The quantity of blood drawn varies with altitude, ambient temperatures, barometric pressure, tube age, venous pressure and filling technique.[2]

Tubes with draw volumes smaller than the apparent dimensions indicated (partial draw tubes) may fill more slowly due to the lower vacuum than tubes of the same size with larger draw volumes. BD Vacutainer® partial draw tubes, or smaller draw volume tubes are identified by their BD Hemogard™ translucent closures, except for: BD Vacutainer® SST™, BD Vacutainer® PST™ and BD Vacutainer® fluoride (gray top) tubes.

The choice of blood collection tubes with smaller draw volumes may benefit the patient and facility. These choices will demonstrate compliance with CAP recommendations for minimizing unnecessary large blood draw volume. As noted in the CAP Gen.40500 question: Blood losses from phlebotomy, particularly in pediatric patients and those with many venipunctures, may be a cause of iatrogenic anemia and increased transfusion needs.[7-11]

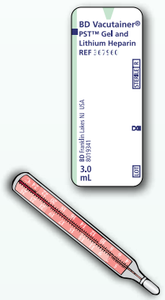
Additionally, the labs will benefit from implementing quality monitoring systems to reject inappropriately filled tubes before conducting any testing, even if these systems are manual.[12]

continued inside

Proper phlebotomy training is critical to ensure collection of the appropriate blood volume.

REVIEW OF COLLECTION TECHNIQUES

Begin by:



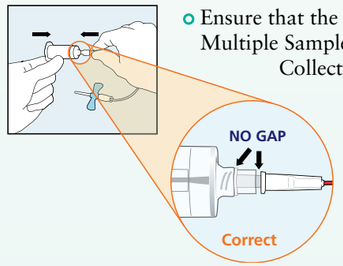
• Checking the expiration date on the product label to ensure the tubes are in-date:

- BD does not recommend the use of expired tubes. The tubes are acceptable to the last day of the stated month and year. The expiration date is most commonly determined by the ability to retain vacuum needed to assure acceptable draw volume.
- BD manufactures the tubes by adhering to the Clinical Laboratory Standards Institute (CLSI) guidelines by testing the draw and fill accuracy at the time of manufacture.[13]

• Checking storage temperature:

- Ensure the tubes are stored within 4°C-25°C (39°F – 77°F).[2]

• Checking the assembly of the blood collection systems:



- Ensure that the BD Vacutainer® One Use Holder (364815) is assembled on the BD Vacutainer® Multiple Sample Luer Adapter, which comes attached to the BD Vacutainer® Push Button Blood Collection Set and BD Vacutainer® Safety-Lok™ Blood Collection Set. Thread the holder on until it is seated securely. There should not be a gap between the holder and the needle. This is best accomplished by holding the Luer Adapter securely and turning the holder onto the needle threads.
- Check that the connection of the BD Vacutainer® Multiple Sample Luer Adapter, which comes pre-attached to the wing set is securely fastened at the end of the tubing. This is accomplished by pushing it toward the holder.

• Checking if a discard tube is being used with blood collection sets:

- Drawing a discard tube will displace the air from the blood collection set tubing to ensure proper blood draw volume. Pulling in this air will result in under filling the tube, thus causing an incorrect blood-to-additive ratio.
- BD blood collection sets are available with 7 inch or 12 inch tubing. The approximate dead space volumes are equal to 0.5 mL for the 12 inch tubing and 0.3 mL for the 7 inch tubing.[14]

• Checking proper needle positioning in the patient's vein during the venipuncture technique:

- Needle positioning resulting in failure to draw:

Correct insertion technique:
Blood flows freely into needle.

Incorrect insertion:

Bevel on lower wall of vein does not allow blood to flow.

Bevel on upper wall of vein does not allow blood to flow.

Needle partially inserted into vein causes blood leakage into tissue.

Needle inserted through both vein walls.

Collapsed vein.

Corrective actions:

Bevel on lower or upper vein wall
- Pull back slightly on the needle
- Avoid: rotating the needle or changing the angle of the needle. This may change the direction of the needle in the vein

Needle partially inserted
- If a hematoma begins to form, then immediately remove the tourniquet and remove the needle. Elevate the arm above the patient's heart and apply pressure. Do not bend patient's arm

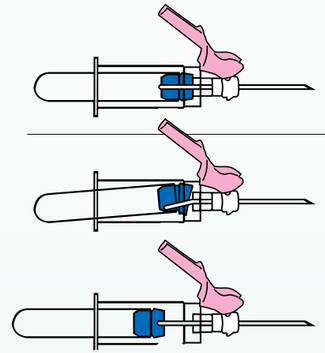
Puncture through vein
- Withdraw the needle slightly to establish blood flow

Collapsed vein
- Tighten the tourniquet by grasping the ends with one hand and twisting them together. If the blood flow does not resume, remove the tube from the needle, wait a few seconds for blood flow to re-establish and insert a smaller volume tube
- Remove the needle

Rolling vein
- Remove the tube from the needle
- Withdraw the needle until the bevel is just under the skin, anchor the vein and redirect the needle into the vein

• Checking the position of the tube in the needle holder:

Improper insertion of tube resulting in an incompletely punctured stopper



Proper insertion of evacuated tube

1 Correct
Proper insertion of tube into holder.

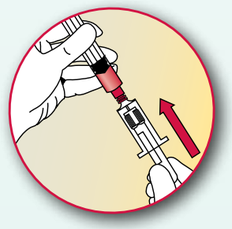
2 Incorrect
Improper insertion resulting in an incompletely punctured stopper.

3 Incorrect
Partially punctured stopper.

- **Push Back –** causes the tube stopper to occlude the needle

Ensure the tube is held in place.

- Ensure that the tube is held in place on the back end of the needle to allow the blood to fill the tube to the stated draw volume until the blood flow has ceased.
- Holding the tube in place ensures that the non-patient end of the needle properly pierces the stopper, providing an adequate blood flow for a quality collection.
- Removing the tube prematurely will also result in under filling.
- The use of BD Vacutainer® Ribbed Pediatric tube adapter (Ref# 364597) will allow the phlebotomist to collect 10.25 mm diameter tubes and larger diameter tubes. The adapter properly aligns the 10.25 mm tubes to the non-patient end of the needle in the holder.



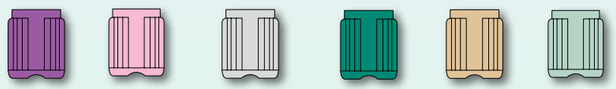
Checking proper techniques for syringe-to-tube transfers:

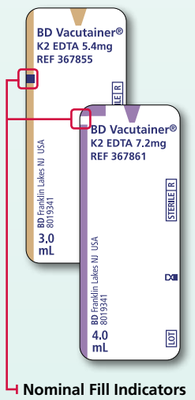
Allow the vacuum in the tube to draw the blood from the syringe using a BD Vacutainer® Blood Transfer Device. Do not force the blood into the tube, as this may result in overfilling or the potential for a blood exposure if the excessive pressure in the tube results in the cap coming off.

• BD Vacutainer® blood collection tube labels are designed with nominal fill indicators.

It is important to note that label placement can vary slightly from tube to tube. For this reason, fill indicators are approximate indicators of expected fill volume.

The nominal fill indicator on our other BD Vacutainer® Plus Tubes remains unchanged. Tubes are intended to fill approximately to the fill indicator. It is important to note that label placement can vary slightly from tube to tube. For this reason, fill indicators are approximate indicators of expected fill volume.





continued on back page