# Tech Talk

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*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 importance of properly processing a BD Vacutainer® SST™ Tube?**

**A.** The preparation of blood samples is a critical first step in the testing process. By understanding the components of the product and adhering to the following processing instructions, the facility may dramatically *IMPROVE SPECIMEN INTEGRITY*, resulting in a *QUALITY SPECIMEN*, a *QUALITY RESULT*, and ultimately assisting the doctor in providing *QUALITY TREATMENT* to patients.

## Components of the BD Vacutainer® SST™ Tube

***TUBE TYPES***
Plus Plastic – Polyethylene Terephthalate (PET); Glass – Soda Lime Glass

***CLOSURE TYPES***
BD Hemogard™ Closure; Conventional Stopper

***ADDITIVES***
Clot Activator – Micronized Silica Particles; Barrier – Polymer Gel; Silicone Coating

In general, glass is a natural clotting agent. The blood will clot due to contact activation causing the initiation of the clotting mechanism.

Plastic tubes require the clot activator, which helps accelerate the blood clotting mechanism.

Silicone and clot activator are applied to the interior surface of the tube.

- A silicone coating on the walls of most serum tubes reduces the adherence of red cells to the tube wall.[1, 2]
- The clot activator helps accelerate the blood clotting mechanism.[1]
- The density of the polymer gel causes it to move upward during centrifugation to the serum-clot interface, where it forms a barrier separating serum from the clot.[1]

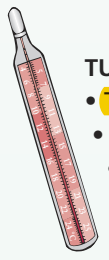
## The Importance of Proper Handling and Processing of the BD Vacutainer® SST™ Tube


### *PRECENTRIFUGATION*

**FILL tubes to the stated draw volume to ensure the proper blood-to-additive ratio.**

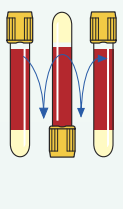
Allow the tube to fill until the vacuum is exhausted and blood flow ceases.[3]

Most BD SST™ tubes have a 12-month shelf life.



**TUBE STORAGE**

- Tubes should be stored at 4-25°C (39-77°F).
- Tubes should not be used beyond the designated expiration date.
- The expiration date is assigned to ensure adequate vacuum, barrier, or additive performance.



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**MIX the tube by 5 complete inversions.**

- Mixing is critical to achieving appropriate clotting times and clot formation.
- Mixing facilitates dispersion of the silica into the blood, assisting the clotting process.
- Inadequate mixing may result in incomplete clotting.


**30 minutes**

**CLOT for 30 minutes in a vertical position in a tube rack. Observe a dense clot.**

- The recommended 30-minute minimum clotting time for the BD SST™ tube is based upon an intact clotting process.
- Insufficient clotting (short clotting time) can result in the formation of fibrin. This fibrin formation may interfere with barrier formation.
- Samples from certain populations of patients with impaired coagulation may require longer than 30 minutes to clot in a BD SST™ tube:
  - Blood from patients on anticoagulant therapy (e.g., Coumadin®) may require longer clotting time.
  - Blood from patients on high doses of heparin may not clot at all.
  - Certain diseases may require longer blood clotting times (e.g., liver disease).
  - Multiple Myeloma—the isolated myeloma globulin inhibits all three stages of fibrin formation: the proteolytic action of thrombin on fibrinogen, the aggregation of fibrin monomers, and the stabilization of fibrin by cross-linkages in the gamma and alpha chains.[4]

It is recommended that serum be physically separated from contact with cells as soon as possible with a **maximum time limit of 2 hours from the time of collection**, unless conclusive evidence indicates that longer contact times do not contribute to error of the results.[1, 8]

### *CENTRIFUGATION*

The gel exhibits thixotropic properties (such that it is semi-solid under static conditions and becomes less viscous when a force is applied), enabling it to flow during centrifugation. Separator gels are designed with a specific density that falls between those of the serum and cells, thus determining the location of the interface.[5]

**Complete and adequate barrier formation is time, temperature and *g*-force dependent.**

**Uniformity of the barrier is time dependent.**

- An incomplete barrier could result from shortened centrifugation times.
- For a horizontal (swing-bucket) centrifuge, the recommended spin time is 10 minutes.
- For a fixed-angle centrifuge, the recommended spin time is 15 minutes.

**A minimum *g*-force is required to get the gel moving, thus the recommendation is 1000 *g*.[1, 5]**

- During the centrifugation process, centrifugal forces are applied to the gel in the tube. At comparable *g*-force settings, the horizontal centrifuge is more efficient at gel barrier formation than a fixed angle centrifuge, due to a higher axial force setting on the gel.


**10 or 15 minutes**

- The quality of the barrier formed from fixed-angle centrifugation also depends upon the angle of the centrifuge head. Barriers formed in fixed-angle centrifuges contain a bias angle relative to the angle of the head. These barriers are typically thinner than horizontal barriers, because the gel must cover a greater cross-sectional area in the tube.

**The flow properties of the barrier material are temperature dependent.[1]**

- Gel flow may be impeded if chilled before or during centrifugation. To optimize flow and prevent heating during centrifugation, set refrigerated centrifuges to 25°C (77°F).[1]

*Centrifugation recommendations:*

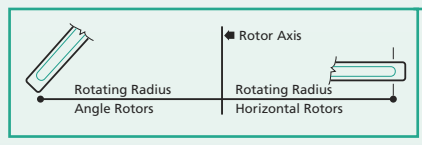
| Product | RCF (*g* force) | Time (min) Swing-Bucket | Time (min) Fixed-Angle Bucket |
|---|---|---|---|
| BD SST™ Glass Tube | 1000-1300 | 10 | 15 |
| BD SST™ Plus - 13 mm | 1100-1300 | 10 | 15 |
| BD SST™ Plus - 16 mm | 1000-1300 | 10 | 15 |
| BD SST™ Transport Tubes | 1100-1300 | 15 | 15 |

*Conversion of RCF to RPM (radius in inches)*

| Radius (Inches) | Speed–RPM Min. | Speed–RPM Max. | Radius (Inches) | Speed–RPM Min. | Speed–RPM Max. |
|---|---|---|---|---|---|
| 3 | 3500 | 4000 | 7 | 2300 | 2600 |
| 4 | 3000 | 3500 | 8 | 2100 | 2400 |
| 5 | 2700 | 3100 | 9 | 2000 | 2300 |
| 6 | 2500 | 2800 | 10 | 1900 | 2200 |

*Conversion of RCF to RPM (radius in centimeters)*

| Radius (cm) | Speed–RPM Min. | Speed–RPM Max. | Radius (cm) | Speed–RPM Min. | Speed–RPM Max. |
|---|---|---|---|---|---|
| 8 | 3300 | 4000 | 16 | 2300 | 2600 |
| 10 | 3000 | 3400 | 18 | 2200 | 2500 |
| 12 | 2700 | 3100 | 20 | 2100 | 2400 |
| 14 | 2500 | 2900 | 25 | 1900 | 2100 |




Radius is the rotational radius of the centrifuge as measured from the center of the rotor head to the outside bottom of the rotor bucket (when the rotor bucket is held at 180 degrees).[1, 8]

### *POSTCENTRIFUGATION*

The specimen in the original tube should be centrifuged one time. Tubes should not be recentrifuged once the barrier is formed. A potential for inaccurate test results is possible. Analytes from cellular leakage/exchange, accentuated by clot retraction, will then be centrifuged into the serum being used for testing. If recentrifugation is required for improved serum quality, then aspirate serum into a properly labeled clean test tube.

References:

1. BD Vacutainer® Evacuated Blood Collection System product insert available from www.bd.com/vacutainer/productinserts
2. Bush V, Skobe C, Dubrowny N, Cohen R, Pando S, Mohammad F. Assessment of Cellular Contamination of Serum for Routine Chemistry Analytes [abstract]. Clin Chem 1997
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4. Soria J, Soria C, Samama M, Fine JM, Bousser J. Analysis of a fibrin formation abnormality in a case of multiple myeloma. *Scand J Haematol.* 1975; 15(3): 207-218
5. Fu CL, Cohen R, Losado R, Bush V. Cellular sedimentaion and barrier formation under centrifugal force in blood collection tubes. *Lab Med.* 2001; 32: 588-592
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8. CLSI, Procedures for the handling and processing of blood specimens; approved guideline. 3rd ed. H18-A3, Vol. 24 No. 38

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