



**STAT Centrifugation Validation of
Vacutainer Tubes with Gel
for Clinical Laboratory Testing**

Performance Validation for Vacutainer® Blood Collection Tubes with Gel

1. PROPOSED INTENDED USE

Vacutainer® Tubes, Holders and Needles are used together as a system for the collection of venous blood. Vacutainer® Tubes with Gel are used to collect, transport and process blood for testing serum, plasma, or whole blood in the clinical laboratory.

2. SPECIFIC AIMS OF THE STUDY

2.1. Demonstrate the equivalent performance of Vacutainer® Tubes with gel barrier when centrifuged at higher relative centrifugal force (RCF or g-force) and shorter centrifugation times when compared to Vacutainer® Tubes with gel when centrifuged according to Instructions-for-use and subsequently tested with representative chemistry assays and/or platelet count.

3. RATIONALE

A clinical validation is needed to demonstrate that blood samples collected in Becton Dickinson Vacutainer® Gel Tubes centrifuged for higher RCF and less time produces test results that are substantially equivalent to Vacutainer® Gel Tubes when spun according to manufacturer recommendations.

4. DEVICE DESCRIPTION

Vacutainer® Evacuated Blood Collection Tubes are plastic tubes with a pre-defined vacuum for exact draw volumes. They are fitted with color coded Vacutainer® Caps. The tubes, additive concentrations, volumes of liquid additives, and their permitted tolerances, as well as the blood-to-additive ratio, are in accordance to the requirements and recommendations of the international standards ISO 6710 “Single use containers for venous blood specimen collection“ and the Clinical and Laboratory Standards Institute’s Approved Standards (CLSI).

Vacutainer® Evacuated Blood Collection Tubes with Gel contain a barrier gel in the tube. The specific gravity of this material lies between the blood cells and plasma. During centrifugation, the gel barrier moves upward, where it forms a stable barrier separating the serum or plasma from cells. Serum or plasma may be aspirated directly from the collection tube, which eliminates the need for transfer to another container.

The purpose of this protocol is to validate the centrifugation of blood collection tubes with gel at higher g-force and lesser time.

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5. OBLIGATIONS OF INVESTIGATOR

- 5.1. The Investigators are responsible for following this protocol and all guidelines regulating this clinical validation.
- 5.2. The Investigators are responsible for ensuring that participating staff members are adequately trained for the tasks performed.
- 5.3. The Investigators are responsible for informing and obtaining consent from all patients.
- 5.4. The Investigators are responsible for the accuracy and completeness of all study records and report forms.
- 5.5. The following persons and site will act as the Investigators for this study at each site:

Site 1: **[Site Name]**

[Address]

Principal Investigator: **[Name]**
[Title]
[Phone]
[Email]

Site 2: **[Site Name]**

[Address]

Principal Investigator: **[Name]**
[Title]
[Phone]
[Email]

Site 3: **[Site Name]**

[Address]

Principal Investigator: **[Name]**
[Title]
[Phone]
[Email]

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6. ELIGIBILITY CRITERIA

6.1. Inclusion Criteria

- 6.1.1. Donors must be at least 18 years old, capable of giving Informed Consent, and meet the site's requirements for blood donation.
- 6.1.2. Blood donations must include the number of tubes designated in the Study Test Plan.

6.2. Exclusion Criteria

- 6.2.1. Sufficient blood could not be collected to adequately fill the number of tubes designated in the Study Test Plan.
- 6.2.2. Blood is severely hemolyzed in the tube following collection and processing. Other factors such as fibrin, turbidity, etc. may be cause for exclusion as well.

7. STUDY DESIGN – METHOD COMPARISON

7.1. Study Design for alternate centrifugation settings (Adjust to your needs)

The purpose of the method comparison study is to demonstrate the equivalent performance of Vacutainer® Gel Tubes [“EvaluationTube”] when centrifuged at higher g-force and lesser time when compared to this same tube when centrifuged according to Vacutainer® Blood Collection Tube Instructions for Use [“Control”], when blood collected in each tube is subsequently tested with representative chemistry assays.

Four 4 mL plasma gel tubes (3 Evaluation Tubes, 1 Control) will be drawn from each of 20 participants. (Adjust to your needs)

After blood collection, the tubes will be centrifuged in a horizontal centrifuge as indicated in the table below. The time between blood collection and centrifugation must not exceed 2 hours.

Table 1

Tube	Centrifugation RCF	Centrifugation Time
Control	1300 xg	10 min
Evaluation A	2000 xg	8 min
Evaluation B	3000 xg	5 min
Evaluation C	4000 xg	3 min

After centrifugation, each Evaluation Tube and the Control Tube will be analyzed using hematology and chemistry assays as indicated in Table 2 below.

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Table 2: Method Comparison Assays

Analyte	Assay	Assay Reference Range	Assay Measuring Range
Alanine Aminotransferase (ALT)			
Albumin (ALB)			
Alkaline Phosphatase (ALP)			
Aspartate Aminotransferase (AST)			
Blood Urea Nitrogen (BUN)			
Calcium (Ca)			
Carbon Dioxide (CO ₂)			
Chloride (Cl)			
Creatinine (Creat)			
Glucose (Glu)			
Potassium (K)			
Sodium (Na)			
Total Bilirubin (TBIL)			
Total Protein (TP)			
Lactate Dehydrogenase (LDH)			
Plasma Platelet Count (Plt) (Lower is better)			

The above assays were selected as representative of typical tests frequently ordered in the clinical chemistry laboratory. Platelet counts are included to give an indication of the cleanliness of the sample and the affect that the cleanliness may have on the chemistry analyzer. Samples will be representative of a normal population and focus only on the impact of centrifugation.

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7.2. Test Plan

- 7.2.1. Collect blood in a randomized tube sequence from 20 donors.
 - 7.2.1.1. Blood will be drawn from each donor into 1 Control Tube and 3 Evaluation Tubes (A, B and C).
 - 7.2.1.2. Blood should be collected from a typical adult population.
- 7.2.2. Mix tubes according to the Instructions for use immediately following collection.
- 7.2.3. Designate each of the 3 Evaluation Tubes as Tube A, B or C and label the Control Tube from each donor. Each donor should have a unique identifying number in addition to the Evaluation Tube or Control Tube designation.
- 7.2.4. Centrifuge the Evaluation Tubes and Control Tube within 2 hours of collection in a horizontal tabletop centrifuge as indicated in Table 1 to separate plasma or serum from cells.
- 7.2.5. Visually inspect all tubes for gel barrier formation and stability immediately following centrifugation. Document, by sample identification number used for evaluation, any visible gel streaming, particles in the plasma, red cells above the gel, etc. Note any abnormalities.
- 7.2.6. Note any pre-analytic issues that could impact analysis, including but not limited to short fill, hemolysis and fibrin, noting the sample identification used for evaluation purposes. Adversely affected samples should be documented and potentially eliminated from the study.
- 7.2.7. Perform analyte testing in duplicate from designated Evaluation and Control Tubes, on a single instrument to eliminate differences attributed to the specific analyzer.
 - 7.2.7.1. Instrument maintenance and calibration should be up to date and the appropriate controls and sufficient reagent loaded to complete required testing.
 - 7.2.7.2. Order of tube analysis should be randomized.
 - 7.2.7.3. Perform testing as soon as possible following blood collection and sample processing (within 4 hours is preferable). Document the time elapsed. Samples and QC material will be analyzed according to the manufacturer's Instructions-for-Use information. Only results with valid QC results will be used in the study.
- 7.2.8. Repeat the test procedure using a second instrument platform if available and sample volume permits.
- 7.2.9. Provide the following documents to the Laboratory Manager or Drucker Diagnostics for analysis and review and keep on file for reference.
 - 7.2.9.1. Copies of all instrument printouts with appropriate sample identification,
 - 7.2.9.2. All data recorded in Excel spreadsheets for ease of manipulation (record all results in US units),
 - 7.2.9.3. Copies of package inserts for all assays and controls used in the study,
 - 7.2.9.4. Other documentation, as needed.

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7.3. Data Analysis

- 7.3.1. All tubes will be visually inspected after centrifugation and before starting analysis.
- 7.3.1.1. Gel barrier should be properly formed and stable and sample should be free of fibrin. Any abnormalities must be documented.
- 7.3.1.2. Tubes should be appropriately filled and sample volume must be adequate for testing required.
- 7.3.1.3. Hemolysis should be evaluated by instrument automated methodology.
- 7.3.2. For the quantitative assays:
- 7.3.2.1. Comparison between Evaluation and Control Tubes will be performed for each analyte assessed by Deming Regression.
- 7.3.2.2. Slope, intercept, their corresponding 95% Confidence Intervals, and the correlation coefficient will be presented.
- 7.3.2.3. Bias will be calculated at the medically relevant levels for each analyte.
- 7.3.2.4. Acceptance Criteria:
- Deming Slope = 1.0 ± 0.15 :
 - Deming Intercept: The 95% Confidence Interval includes 0.00 or is not clinically significant (if the assay's measuring range is narrow)
 - Bias: At the medically relevant levels, the bias is either within the expected precision of the assay or not clinically significant.

8. GENERAL INFORMATION

- 8.1. The Investigator and staff will supply the tubes, assay reagents, calibrators, controls reagents and other consumables as required. Lot numbers of tubes, controls and reagents will be recorded.
- 8.2. Initial testing with the Evaluation Tubes will be performed in the same run as the Control Tubes for each phase of the study in accordance with the testing plan. If possible, all tests should be run in duplicate for improved statistical rigor.
- 8.3. Sample handling precautions and sample limitations should be adhered to as outlined in each assay manufacturer's package insert.
- 8.4. The Investigator will record any factors that may impact analysis results.
- 8.5. Samples must be optimally filled. Gently invert each tube 5-10 times, or as recommended in the Instructions-for-Use, immediately following collection. Do not shake. Vigorous mixing or delayed mixing in plasma tubes may result in clotting and incorrect test results.

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- 8.6. Controls for the performed tests will be included with each test run and used in accordance with reagent and instrument manufacturers' recommended procedures. The manufacturer's guidelines will be followed for operation and maintenance of the instrument.
- 8.7. Daily, weekly and monthly maintenance must be up to date as per manufacturer's instructions and laboratory procedures.
- 8.8. The testing site must complete all data collection and documentation as soon as possible following the completion of the test plan procedures.

9. ACCOUNTABILITY OF INVESTIGATIONAL PRODUCT

Upon completion of the trial, all investigational products must be disposed of according to OSHA, state, and laboratory policies and procedures.

10. STATISTICAL CONSIDERATIONS

The results of all tests will be analyzed as defined in the Data Analysis sections of this protocol to determine the equivalence of centrifugation methods recommended by the tube manufacturer with high-speed and rapid centrifugation methods.

11. FINAL REPORT BY INVESTIGATOR

The Investigator will prepare a report summarizing the results of the trial. A manuscript based on the results of this study may be prepared subsequently and submitted for publication. The authorship of any publications resulting from this study will be the subject of prior agreement between the Investigator and Drucker Diagnostics subject to the provisions of Section 17 below.

12. ADVERSE DEVICE REPORTING

No adverse events (AE) and/or adverse device effects (ADE) are anticipated to be associated with the use of these products. If any are found, they will be documented and reported, per the site's standard procedure.

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13. INFORMED CONSENT

The site's Institutional Review Board approval of the Informed Consent is required for donor participation. The Informed Consent will be obtained per the site's IRB policy using the IRB-approved Informed Consent form as necessary.

14. CONFIDENTIALITY

The site's employees must not share this protocol, tools, data, or any information on the study design with outside parties.

15. PUBLICATION POLICY

The data generated may be used by Drucker Diagnostics for future product development, publication, white papers, brochures, etc.

16. FINANCIAL DISCLOSURE OF THE INVESTIGATOR

I certify that I have no significant equity in Becton Dickinson or Drucker Diagnostics or proprietary interest in the financial acquisition of the products being evaluated, other than the receipt of compensation for the performance of the clinical validation, which was agreed upon prior to the commencement of the validation. I also certify that the compensation I receive is not dependent on the outcome of the trial.

17. STATEMENT OF INVESTIGATOR

I have reviewed this protocol and agree with its contents. I will conduct the trial in an efficient manner and will ensure all participants are adequately trained with the tasks assigned. I also will account that the data are accurately reported. I will notify the sponsor of any problems incurred during the performance of this trial. Any changes or problems will be documented.

Signature **Date**

Investigator (Name and Address)

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Addendum A: Test Results Sheet

Specimen ID #				
Analyte	Control Result	Sample Result A	Sample Result B	Sample Result C
Alanine Aminotransferase (ALT)				
Albumin (ALB)				
Alkaline Phosphatase (ALP)				
Aspartate Aminotransferase (AST)				
Blood Urea Nitrogen (BUN)				
Calcium (Ca)				
Carbon Dioxide (CO2)				
Chloride (Cl)				
Creatinine (Creat)				
Glucose (Glu)				
Potassium (K)				
Sodium (Na)				
Total Bilirubin (TBIL)				
Total Protein (TP)				
Lactate Dehydrogenase (LDH)				
Plasma Platelet Count (Plt) (Lower is better)				