

**510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION  
DECISION SUMMARY**

**A. 510(k) Number:**

K143348

**B. Purpose for Submission:**

Clearance of new device

**C. Manufacturer and Instrument Name:**

Shenzhen Mindray Bio-Medical Electronics Co. LTD, BC-3600 Auto Hematology Analyzer

**D. Type of Test or Tests Performed:**

Complete blood count (WBC, RBC, HGB, HCT, MCV, MCH, MCHC, RDW, PLT, MPV) and leukocyte 3-part differential (Lymph#, Mid#, Gran#, Lymph%, Mid%, Gran%)

**E. System Descriptions:**

1. Device Description:

The BC-3600 Auto Hematology Analyzer is a quantitative, automated hematology analyzer and leukocyte differential counter for in vitro diagnostic use in clinical laboratories. It is only to be used by trained medical professionals to identify the normal patient, with all normal system-generated parameters, and to flag or identify patient results that require additional studies. The analyzer provides analysis results for 16 parameters of human blood and three histograms.

The BC-3600 Auto Hematology Analyzer system consists of: the BC-3600 Auto Hematology Analyzer, M-30D Diluent, M-30CFL Lyse, M-30R Rinse, Probe Cleanser, BC-3D Controls (low, normal and high), and SC-CAL PLUS Calibrator.

2. Principles of Operation:

The BC-3600 Auto Hematology Analyzer (hereafter referred to as BC-3600) uses the impedance method to count and measure the size of WBC, RBC and PLT in human whole blood. The WBC, RBC and PLT are counted in a dedicated channel using the measurement of changes in electrical resistance. These blood cells are suspended in a conductive diluent and hydrodynamic technology is used to ensure the cells pass through an aperture of known dimensions. The intensity of the electronic pulse from the cells passing through the aperture is proportional to the cell volume. HGB is determined by the colorimetric method. In addition, the analyzer uses a volumetric metering unit to control the count cycle and to ensure that a precise volume of sample is analyzed for the measurement.

WBC ( $10^3/\mu\text{L}$ ) is the number of leukocytes measured directly by counting the white blood cells passing through the aperture. The analyzer presents a WBC histogram, whose x-coordinate represents the cell volume (fL), and y-coordinate represents the number of cells. With the help of the diluent and lyse, this analyzer can size the white blood cells into three subpopulations: lymphocytes, mid-sized cells (including monocytes, basophils and eosinophils) and granulocytes (neutrophils). Based on the WBC histogram, the analyzer calculates the Lymph %, Mid %, and Gran % and expresses the results in percentage.

RBC ( $10^6/\mu\text{L}$ ) is the number of erythrocytes measured directly by counting the erythrocytes passing through the aperture. The analyzer also presents a RBC histogram, where the x-coordinate represents the cell volume (fL) and y-coordinate represents the number of cells. Based on the RBC histogram, the analyzer calculates the mean cell volume (MCV) and expresses the result in fL. In addition, the analyzer calculates the Coefficient of Variation of the erythrocyte distribution width (RDW).

HGB is determined by the colorimetric method and expressed in g/dL. In addition, the analyzer uses a volumetric metering unit to control the count cycle and to ensure that a precise volume of sample is analyzed for the measurement.

PLT ( $10^3/\mu\text{L}$ ) is measured directly by counting the platelets passing through the aperture.

3. Modes of Operation:

The BC-3600 operates in closed-vial whole blood or predilute analysis modes.

Does the applicant's device contain the ability to transmit data to a computer, webserver, or mobile device?

Yes  or No

Does the applicant's device transmit data to a computer, webserver, or mobile device using wireless transmission?

Yes  or No

4. Specimen Identification:

Specimen identification input is manual (by operator) or by barcode reader (optional).

5. Specimen Sampling and Handling:

Samples are manually mixed and loaded into a sample compartment one at a time. The BC-3600 processes anticoagulated venous and capillary whole blood collected in  $\text{K}_2\text{EDTA}$  or  $\text{K}_3\text{EDTA}$  collection containers. The BC-3600 has two testing modes, whole blood analysis mode and predilute analysis mode.

6. Calibration:

Calibration and verification of calibration with the use of SC-CAL PLUS calibrator is performed by automated or manual method according to the instructions for use, laboratory procedures, and local or national regulations.

7. Quality Control:

Quality control performance is to be evaluated using BC-3D controls (low, normal, high) at intervals established by laboratory procedures and local or national regulations.

8. Software:

The software is purposed to operate the system featuring sample management, sample processing, data acquisition, data processing, result management, patient data management, and instrument management.

FDA has reviewed applicant's Hazard Analysis and Software Development processes for this line of product types:

Yes \_\_\_X\_\_\_ or No \_\_\_\_\_

**F. Regulatory Information:**

1. Regulation section:

21 CFR § 864.5220, Automated differential cell counter

2. Classification:

Class II

3. Product code:

GKZ – Counter, Differential Cell

4. Panel:

Hematology (81)

**G. Intended Use:**

1. Indication(s) for Use:

The BC-3600 auto hematology analyzer is a quantitative, automated hematology analyzer for in vitro diagnostic use in clinical laboratories. The BC-3600 auto hematology analyzer provide complete blood count (WBC, RBC, HGB, HCT, MCV, MCH, MCHC, RDW, PLT, MPV) and leukocyte 3-Part differential (Lymph#, Mid#, Gran#, Lymph%, Mid%, Gran%) for whole blood specimens, collected in a salt of EDTA [dipotassium (K<sub>2</sub>) or tripotassium (K<sub>3</sub>)] obtained by venipuncture or fingerstick. The purpose of the BC-3600 Auto Hematology Analyzer is to identify the normal human patient, with normal system-generated parameters, from patients whose results require additional studies.

2. Special Conditions for Use Statement(s):  
For prescription use only.

**H. Substantial Equivalence Information:**

1. Predicate Device Name(s) and 510(k) numbers:  
BC-3200 Hematology Analyzer (K093394)
2. Comparison with Predicate Device:

<b>Similarities</b>		
<b>Item</b>	<b>Device</b>	<b>Predicate</b>
Intended Use	The BC-3600 Auto Hematology Analyzer is a quantitative, automated hematology analyzer for in vitro diagnostic use in clinical laboratories. The BC-3600 Auto Hematology Analyzer provides complete blood count (WBC, RBC, HGB, HCT, MCV, MCH, MCHC, RDW, PLT, MPV) and leukocyte 3-part differential (Lymph#, Mid#, Gran#, Lymph%, Mid%, Gran%) for whole blood specimens, collected in a salt of EDTA [dipotassium (K <sub>2</sub> ) or tripotassium (K <sub>3</sub> )] obtained by venipuncture or fingerstick. The purpose of the BC-3600 Auto Hematology Analyzer is to identify the normal human patient, with normal system-generated parameters, from patients whose results require additional studies.	The BC-3200 auto hematology analyzer is a quantitative, automated hematology analyzer and leukocyte differential counter to be used in clinical laboratories for In Vitro Diagnostic purpose. The intended use of BC-3200 Auto Hematology Analyzer is to identify the normal patient, with all normal system-generated parameters, and to flag or identify patient results that require additional studies.
Test Principle	WBC, RBC, MCV, RDW, PLT and MPV: Coulter Principle of Impedance  HGB: colorimetric method  WBC Differential: instrument calculation of a three-population leukocyte count (Lymph%, Mid%, Gran%) taken from the WBC histogram based on cell size determined by impedance method. The absolute number for each population is then calculated.	Same
Mode of Operation	Manual presentation of closed-vial for whole blood or predilute analysis modes.	Same
Sample Processing	Utilizes an automatic sampling, diluting and mixing device for sample processing.	Same
Sample Identification	Manual barcode scan of sample tube identifier or manual keyboard entry of sample identifier.	Same
System	60 samples per hour	Same

Similarities		
Item	Device	Predicate
Throughput		
Data Analysis	Analyze analog raw data to generate reported parameters	Same
Data Reporting	Display, printing and transmission of data to LIS/HIS.	Same
Quality Control	BC-3D Controls (low, normal and high)	Same
Calibrator	SC-CAL PLUS Calibrator	Same
Analysis Reagents	M-30D Diluent M-30CFL Lyse M-30R Rinse	Same

Differences		
Item	Device	Predicate
Sample Type	Anticoagulated (K <sub>2</sub> EDTA or K <sub>3</sub> EDTA) venous and capillary whole blood	Anticoagulated (K <sub>2</sub> EDTA) whole blood
Cleaning Agents	Probe Cleanser	M-30P Probe Cleanser M-30E E-Z Cleanser
Sample Aspiration Volume	Whole blood analysis mode: 21 µL of whole blood  Predilute analysis mode: 20 µL of blood to prepare a diluted sample	Whole blood analysis mode: 13 µL of whole blood  Predilute analysis mode: 20 µL of blood to prepare a diluted sample
Display	TFT Color Touch Screen, 800×600 pixels	Color LCD, 10.4-inch, 800x600 pixels
I/O Interfaces	One LAN interface, built-in network card, TCP/IP compatible  One RS-232 port to support the host connected to LIS with serial port  4 USB ports	One keyboard interface  Two RS-232 interfaces One parallel port  One power supply for the floppy disk drive

**I. Special Control/Guidance Document Referenced (if applicable):**

Class II Special Controls Guidance Document: Premarket Notifications for Automated Differential Cell Counters for Immature or Abnormal Blood Cells; Final Guidance for Industry and FDA

CLSI H26-A2, Validation, Verification, and Quality Assurance of Automated Hematology Analyzers; Proposed Standard – Second Edition

CLSI EP06-A, Evaluation of the Linearity of Quantitative Measurement Procedures: A Statistical Approach; Approved Guideline

CLSI H20-A2, Reference Leukocyte (WBC) Differential Count (Proportional) and

Evaluation of Instrumental Methods; Approved Standard – Second Edition

CLSI EP09-A3, Measurement Procedure Comparison and Bias Estimation Using Patient Samples; Approved Guideline – Third Edition

CLSI EP17-A, Protocols for Determination of Limits of Detection and Limits of Quantitation; Approved Guideline

CLSI EP05-A2, Evaluation of Precision Performance of Quantitative Measurement Methods; Approved Guideline – Second Edition

CLSI EP28-A3c, Defining, Establishing, and Verifying Reference Intervals in the Clinical Laboratory; Approved Guideline – Third Edition

**J. Performance Characteristics:**

1. Analytical Performance:

a. *Method Comparison*

Method comparison studies were performed within three clinical sites to assess the performance of the BC-3600 analyzer compared to the BC-3200 analyzer utilizing a total of 1222 K<sub>2</sub>EDTA venous whole blood samples. The study population included normal and abnormal pediatric and adult subjects.

Statistical analyses for the method comparison, demonstrating correlation between the BC-3600 and the BC-3200 analyzers were provided based on Deming, weighted Deming, and Passing-Bablok regressions for each blood parameter, along with point estimates and 95% confidence intervals at five clinical evaluation points.

Correlation and Estimated Bias of BC-3600 Compared to BC-3200 - Combined Sites

Parameter	(r)	Slope	95% CI		Intercept (95% CI)	95% CI		Mean	
			Lower Limit	Upper Limit		Lower Limit	Upper Limit	BC-3200	BC-3600
WBC	0.999	0.990	0.988	0.992	0.1861	0.152	0.220	11.29	11.36
Lymph#	0.985	1.0665	1.057	1.076	-0.155	-0.176	-0.0134	2.16	2.15
Mid#	0.879	0.921	0.895	0.947	0.0505	0.034	0.067	0.60	0.60
Gran#	0.998	1.0674	1.064	1.071	-0.2177	-0.242	-0.193	5.96	6.15
Lymph%	0.982	1.098	1.088	1.108	-3.2854	-3.615	-2.956	30.67	30.39
Mid%	0.677	0.577	0.544	0.610	3.2976	3.031	3.564	8.28	8.07
Gran%	0.985	1.0462	1.037	1.055	-1.9542	-2.524	-1.385	62.48	63.41
RBC	0.997	1.0098	1.007	1.013	-0.0296	-0.043	-0.016	4.25	4.26
HGB	0.998	1.0055	1.003	1.008	-0.1434	-0.178	-0.109	12.45	12.37
HCT	0.997	0.9829	0.980	0.986	0.8568	0.732	0.982	38.03	38.23
MCV	0.994	1.0132	1.009	1.018	-0.875	-1.27	-0.48	90.46	90.77
MCH	0.991	1.0087	1.003	1.014	-0.4767	-0.641	-0.312	29.58	29.36

Correlation and Estimated Bias of BC-3600 Compared to BC-3200 - Combined Sites

Parameter	(r)	Slope	95% CI		Intercept	95% CI		Mean	
			Lower Limit	Upper Limit		Lower Limit	Upper Limit	BC-3200	BC-3600
MCHC	0.915	0.943	0.926	0.959	1.4625	0.922	2.003	32.69	32.28
RDW	0.939	1.104	1.088	1.120	-1.4722	-1.709	-1.235	14.55	14.59
PLT	0.992	0.9847	0.979	0.990	7.0335	5.453	8.614	260.56	263.61
MPV	0.865	0.793	0.773	0.813	1.6200	1.452	1.788	8.48	8.34

Clinical sensitivity and specificity studies were conducted to evaluate the flagging capabilities of the BC-3600 analyzer in comparison to manual light microscopy using a total of 1208 patient samples representing a number of abnormal conditions.

Total	Manual			Value	
	P	N	Total		
BC-3600				Efficiency	75.9%
P	178	227	405	FP%	23.5%
N	64	739	803	FN%	26.4%
Total	242	966	1208	Sensitivity	73.6%
				Specificity	76.5%

c. Precision/Reproducibility

Precision performance of the BC-3600 was evaluated by performing repeatability and reproducibility studies across three clinical laboratory sites.

The repeatability study was conducted with normal and abnormal venous whole blood samples collected in K<sub>2</sub>EDTA collection containers. The samples were selected to span the lower, normal and upper limits of the analytical measuring range. Each sample was analyzed 10 consecutive times in the whole blood and predilute analysis modes.

Reproducibility performance was conducted over 20 operating days utilizing three levels of commercial control material (BC-3D low, normal, and high) performing two runs per day and two replicates per run, yielding a total of 80 replicates per control level. To further demonstrate precision performance, SD and CV% of within-run, between-run, between-day, and within-device were calculated per site and for the combined sites as shown below.

BC-3D Low Level Control (N=240)

Parameter	Mean	Within-run		Between-run		Between-day		Between-device		Total	
		SD	CV%	SD	CV%	SD	CV%	SD	CV%	SD	CV%
WBC	1.94	0.06	3.16	0.00	0.00	0.05	2.68	0.12	6.24	0.15	7.49
Lymph#	1.11	0.05	4.71	0.00	0.00	0.04	3.65	0.09	7.81	0.11	9.82
Mid#	0.19	0.04	20.35	0.00	0.00	0.01	4.90	0.00	0.00	0.04	20.93

Parameter	Mean	Within-run		Between-run		Between-day		Between-device		Total	
		SD	CV%	SD	CV%	SD	CV%	SD	CV%	SD	CV%
Gran#	0.64	0.04	6.08	0.02	2.48	0.00	0.00	0.03	5.33	0.05	8.46
Lymph%	57.47	1.17	2.04	0.61	1.06	0.58	1.01	0.94	1.64	1.73	3.00
Mid%	9.33	0.76	8.13	0.00	0.00	0.16	1.71	0.11	1.21	0.78	8.39
Gran%	33.20	0.96	2.90	0.49	1.49	0.53	1.59	0.83	2.51	1.47	4.41
RBC	2.44	0.02	0.85	0.01	0.32	0.02	0.68	0.06	2.63	0.07	2.87
HGB	5.91	0.04	0.74	0.05	0.90	0.02	0.40	0.20	3.37	0.21	3.58
HCT	18.41	0.16	0.87	0.08	0.43	0.14	0.74	0.39	2.13	0.45	2.45
MCV	75.58	0.15	0.20	0.27	0.36	0.53	0.70	0.45	0.60	0.76	1.00
MCH	24.26	0.23	0.93	0.22	0.91	0.13	0.55	0.17	0.71	0.38	1.58
MCHC	32.09	0.29	0.92	0.23	0.72	0.19	0.59	0.40	1.24	0.58	1.80
RDW	15.08	0.12	0.80	0.09	0.60	0.11	0.71	0.68	4.53	0.71	4.69
PLT	69.22	3.18	4.59	0.84	1.21	2.38	3.44	2.13	3.07	4.58	6.62
MPV	8.12	0.23	2.79	0.00	0.00	0.00	0.00	0.49	6.01	0.54	6.63

BC-3D Normal Level Control (N=240)

Parameter	Mean	Within-run		Between-run		Between-day		Between-device		Total	
		SD	CV%	SD	CV%	SD	CV%	SD	CV%	SD	CV%
WBC	7.81	0.11	1.43	0.03	0.35	0.11	1.44	0.17	2.20	0.23	3.01
Lymph#	2.38	0.07	2.91	0.02	0.67	0.07	2.81	0.09	3.89	0.13	5.66
Mid#	0.51	0.03	6.57	0.01	2.53	0.00	0.00	0.01	1.14	0.04	7.13
Gran#	4.92	0.09	1.82	0.01	0.23	0.04	0.80	0.09	1.79	0.13	2.69
Lymph%	30.43	0.60	1.98	0.00	0.00	0.43	1.41	0.57	1.86	0.93	3.06
Mid%	6.77	0.29	4.24	0.00	0.00	0.09	1.29	0.24	3.52	0.38	5.66
Gran%	62.80	0.59	0.94	0.08	0.12	0.46	0.73	0.33	0.52	0.82	1.30
RBC	4.72	0.03	0.72	0.02	0.42	0.02	0.52	0.12	2.58	0.13	2.76
HGB	13.76	0.08	0.56	0.07	0.48	0.07	0.49	0.45	3.30	0.47	3.42
HCT	40.82	0.31	0.76	0.17	0.41	0.22	0.53	0.74	1.82	0.85	2.08
MCV	86.43	0.15	0.18	0.24	0.27	0.42	0.49	0.64	0.74	0.82	0.94
MCH	29.12	0.19	0.64	0.15	0.50	0.09	0.32	0.21	0.74	0.33	1.15
MCHC	33.70	0.23	0.69	0.11	0.32	0.09	0.28	0.50	1.47	0.57	1.68
RDW	14.26	0.10	0.68	0.08	0.55	0.12	0.84	0.59	4.16	0.62	4.33
PLT	257.09	6.85	2.66	0.25	0.10	1.91	0.74	4.35	1.69	8.34	3.24
MPV	7.81	0.10	1.27	0.03	0.41	0.05	0.68	0.27	3.49	0.30	3.80

BC-3D High Level Control (N=240)

Parameter	Mean	Within-run		Between-run		Between-day		Between-device		Total	
		SD	CV%	SD	CV%	SD	CV%	SD	CV %	SD	CV %
WBC	20.81	0.20	0.95	0.03	0.16	0.16	0.77	0.37	1.79	0.45	2.17
Lymph#	2.92	0.07	2.56	0.00	0.00	0.06	2.08	0.08	2.91	0.13	4.40
Mid#	0.93	0.05	5.56	0.00	0.00	0.02	1.67	0.03	3.63	0.06	6.85
Gran#	16.97	0.18	1.09	0.00	0.00	0.12	0.68	0.42	2.50	0.48	2.81
Lymph%	14.02	0.29	2.09	0.05	0.32	0.23	1.63	0.66	4.70	0.76	5.41
Mid%	4.51	0.19	4.24	0.00	0.00	0.07	1.49	0.08	1.87	0.22	4.87

Parameter	Mean	Within-run		Between-run		Between-day		Between-device		Total	
		SD	CV%	SD	CV%	SD	CV%	SD	CV %	SD	CV %
Gran%	81.47	0.36	0.44	0.00	0.00	0.21	0.25	0.60	0.74	0.73	0.90
RBC	5.81	0.04	0.74	0.03	0.51	0.02	0.42	0.21	3.56	0.21	3.70
HGB	18.85	0.07	0.39	0.06	0.30	0.10	0.51	0.66	3.49	0.67	3.56
HCT	54.59	0.40	0.73	0.29	0.54	0.22	0.39	1.86	3.40	1.93	3.54
MCV	94.02	0.16	0.17	0.24	0.25	0.56	0.60	0.28	0.30	0.69	0.74
MCH	32.47	0.22	0.69	0.15	0.45	0.09	0.28	0.15	0.46	0.32	0.98
MCHC	34.53	0.23	0.66	0.13	0.38	0.13	0.37	0.05	0.13	0.30	0.86
RDW	13.47	0.08	0.63	0.06	0.43	0.13	0.93	0.78	5.78	0.80	5.90
PLT	526.38	10.66	2.03	4.19	0.80	3.09	0.59	17.78	3.38	21.38	4.06
MPV	7.96	0.07	0.93	0.01	0.11	0.04	0.50	0.30	3.82	0.32	3.96

*c. Linearity*

Linearity of the WBC, PLT, RBC, and HGB parameters was evaluated on three instruments at one clinical laboratory site. WBC and PLT linearity samples were derived from commercial linearity material diluted to different levels spanning the targeted range. Fresh whole blood diluted to different levels was utilized for RBC and HGB linear range studies. Relative concentrations of each dilution were obtained using the density-weight method.

Parameter	Linearity Range
WBC	0.3–99.9×10 <sup>3</sup> /μL
RBC	0.20–7.99×10 <sup>6</sup> /μL
HGB	1.0–24.9 g/dL
PLT	10–999×10 <sup>3</sup> /μL

*d. Carryover*

Carryover was determined for the following parameters: WBC, RBC, HGB and PLT. Testing was performed to test the different analytical cycle combinations of within-mode for whole blood, within-mode for predilute and mode-to-mode.

For whole blood and predilute sampling, within-mode and mode-to-mode sampling carryover were tested. To assess within-mode carryover of the whole blood and predilute modes, three high concentration (H1, H2, and H3) samples were consecutively analyzed followed by three low concentration (L1, L2, and L3) samples.

To assess whole blood to predilute mode carryover three whole blood high concentration samples were analyzed followed by three consecutive runs of low concentration pre-diluted samples. To assess predilute to whole blood mode carryover, three high concentration prediluted samples were analyzed followed by three

consecutive runs of low concentration whole blood samples.

Carryover % was determined using the following calculation: % Carryover =  $(LTV1-LTV3) / (HTV3-LTV3) \times 100$ . The results of the carryover study were within the predefined specifications of  $\leq 0.5\%$  for WBC, RBC, HGB, and  $\leq 1.0\%$  for PLT.

*e. Interfering Substances*

A study was conducted to determine the interference level of bilirubin and intralipid with the hematology results of the BC-3600 analyzer. Ten whole blood samples were collected for each interference study and contrived with commercially derived bilirubin or intralipid. Each sample was contrived to yield five interferent concentrations and analyzed in the whole blood analysis mode.

There was no significant bilirubin interference up to a concentration of 500 mg/L for the WBC, Lymph#, Mid#, Gran#, Lymph%, Mid%, Gran%, RBC, HCT, MCV, MCH, MCHC, RDW, PLT and MPV parameters; and no significant bilirubin interference up to a concentration of 40 mg/L for the HGB parameter.

There was no significant intralipid interference up to a concentration of 11.7 g/L for the following parameter: WBC, Lymph#, Mid#, Gran#, Lymph%, Mid%, Gran%, RBC, HCT, MCV, RDW, PLT and MPV.

2. Other Supportive Instrument Performance Data Not Covered Above:

*a. Sample Stability*

To determine sample stability, 35 whole blood specimens collected in K<sub>2</sub>EDTA were analyzed in the whole blood analysis mode, and 25 whole blood specimens collected in K<sub>2</sub>EDTA were analyzed in the predilute analysis mode. Aliquots were prepared and stored at the defined condition for each specimen, then analyzed in duplicate at different time points according to the study design. When samples were stored for the durations defined at controlled room temperature [64–79° F (18–26° C)] or at refrigerated temperature [35.6–46.4° F (2–8° C)] the analyzer performance met the defined acceptance criteria. Predilute whole blood sample stability is 30 minutes when stored at 18–26°C after preparation for all parameters. Whole blood sample stability of all parameters is listed in the following table.

<b>Parameter</b>	<b>Whole blood stability at 18–26°C (hours)</b>	<b>Whole blood stability in at 2–8°C (hours)</b>
WBC	12	24
Lymph#	8	24
Mid#	8	24
Gran#	8	24

Parameter	Whole blood stability at 18–26°C (hours)	Whole blood stability in at 2–8°C (hours)
Lymph%	8	24
Mid%	8	24
Gran%	8	24
RBC	12	24
HGB	12	24
HCT	12	24
MCV	12	24
MCH	12	24
MCHC	12	24
RDW	12	24
PLT	12	24
MPV	12	24

*b. Whole Blood vs. Predilute Analysis Mode Comparison*

To demonstrate equivalence between the whole blood and predilute analysis modes, 61 paired whole blood samples (collected in K<sub>2</sub>EDTA), representing normal and abnormal medical conditions were and analyzed in each mode. Results were provided based on Deming, weighted Deming, or Passing-Bablok regressions along with point estimates and 95% confidence intervals at five clinical evaluation points. Results were within the defined acceptance criteria.

Parameter	(r)	Slope	95% CI		Intercept (95% CI)	95% CI		Mean	
			Lower Limit	Upper Limit		Lower Limit	Upper Limit	BC-3200	BC-3600
WBC	1.000	0.982	0.969	0.996	0.05	-0.04	0.14	12.55	12.4
Lymph#	0.999	1.094	1.024	1.163	-0.11	-0.22	0.01	3.45	3.55
Mid#	0.965	1.000	0.857	1.000	-0.10	-0.10	0.01	0.92	0.95
Gran#	1.000	0.991	0.953	1.029	0.00	-0.16	0.17	7.96	7.91
Lymph%	0.996	1.043	1.014	1.072	-0.02	-0.74	0.69	27.41	28.56
Mid%	0.737	0.765	0.615	0.980	1.08	-0.54	2.12	8.51	7.48
Gran%	0.988	0.994	0.967	1.022	0.38	-1.57	2.34	64.82	63.97
RBC	0.996	0.983	0.973	0.993	0.011	-0.20	0.041	4.23	4.18
HGB	0.997	0.985	0.976	0.994	0.08	0.01	0.15	12.33	12.23
HCT	0.996	0.980	0.961	0.998	-0.26	-0.99	0.48	38.46	37.42
MCV	0.997	1.021	1.002	1.039	-3.06	-4.71	1.40	92.02	90.86
MCH	0.997	0.996	0.979	1.013	0.28	-0.23	0.80	29.47	29.64
MCHC	0.931	0.882	0.819	0.945	4.37	2.36	6.39	31.93	32.54
RDW	0.992	1.021	0.982	1.060	-0.35	-0.91	0.22	14.72	14.68
PLT	0.997	0.974	0.915	1.033	1.3	-7.6	10.3	230.02	223.41
MPV	0.943	0.968	0.838	1.097	0.42	-0.61	1.45	8.58	8.73

c. *Anticoagulant Comparison (K<sub>2</sub>EDTA vs. K<sub>3</sub>EDTA)*

A total of 60 paired fresh whole blood samples collected in K<sub>2</sub>EDTA and K<sub>3</sub>EDTA anticoagulant tubes were analyzed on the BC-3600 analyzer in the whole blood analysis mode at one site. The samples were selected to cover the analytical measuring range and medical decision levels for each parameter. The results were analyzed according to CLSI EP09-A3 and were within the defined acceptance criteria.

d. *Sample Matrix Comparison (venous vs. fingerstick)*

A total of 52 paired whole blood specimens were collected from each subject by capillary method in a K<sub>2</sub>EDTA microtainer and by venipuncture method in a K<sub>2</sub>EDTA collection tube, and analyzed in the BC-3600 whole blood analysis mode. Specimens were selected to cover the analytical measuring range and medical decision levels for each parameter. The results were analyzed according to CLSI EP09-A3 and were within the defined acceptance criteria.

e. *Determination of limit of blank, lower limits of detection and quantitation*

Limit of Blank (LoB) was determined using five blank samples containing the predilute solution (diluent).

To determine the Limit of Detection (LoD) and Limit of Quantitation (LoQ), five low level samples were derived by adding whole blood to diluent. Five replicate measurements of the low level samples were performed in the whole blood analysis mode to verify precision at the lower end of the analytical measuring range.

Parameter	LoB	LoD	LoQ
WBC	0 x 10 <sup>3</sup> /μL	0.05 x 10 <sup>3</sup> /μL	0.05 x 10 <sup>3</sup> /μL
PLT	2.1 x 10 <sup>3</sup> /μL	3.4 x 10 <sup>3</sup> /μL	3.4 x 10 <sup>3</sup> /μL

f. *Background Counts*

Background count specifications were verified by analyzing M-30D Diluent in the whole blood and predilute analysis modes. The results demonstrated that the background counts were within the predefined acceptance criteria.

Parameter	Background Specifications
WBC	≤ 0.3 x 10 <sup>3</sup> /μL
RBC	≤ 0.03 x 10 <sup>6</sup> /μL
HGB	≤ 0.1 g/dL
PLT	≤ 5 x 10 <sup>3</sup> /μL

g. *Reference Intervals*

Adult reference intervals were assessed utilizing whole blood samples collected from 255 normal subjects between the ages of 19–85 (124 male and 131 female), representative of the United States population. The non-parametric method was utilized to calculate the lower and upper limits of the reference ranges. Confidence intervals for the reference limits were calculated using a 90% probability (90% CI).

Parameter	Male (N=124)		Female (N=131)		Overall (N=256)	
	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit
WBC ( $\times 10^3/\mu\text{L}$ )	4.11	12.29	4.23	13.21	4.20	12.36
Lymph# ( $\times 10^3/\mu\text{L}$ )	1.00	3.70	0.89	5.14	1.00	4.16
Mid# ( $\times 10^3/\mu\text{L}$ )	0.40	1.48	0.23	1.10	0.30	1.20
Gran# ( $\times 10^3/\mu\text{L}$ )	2.10	8.65	2.03	7.61	2.10	8.26
Lymph%	14.83	45.40	15.72	50.75	14.88	47.56
Mid%	4.84	16.20	4.43	13.93	4.54	14.56
Gran%	43.55	77.09	40.36	78.18	42.20	77.06
RBC ( $\times 10^6/\mu\text{L}$ )	3.578	5.856	3.528	5.704	3.558	5.794
HGB (g/dL)	10.58	17.36	10.43	16.04	10.50	16.90
HCT (%)	33.71	50.90	33.60	47.42	33.60	50.32
MCV (fL)	77.03	100.94	71.28	99.91	75.66	100.10
MCH (pg)	24.69	33.88	22.14	33.47	23.70	33.56
MCHC (g/dL)	31.51	34.90	31.03	34.50	31.24	34.90
RDW (%)	11.4	15.84	11.53	15.22	11.64	15.40
PLT ( $\times 10^3/\mu\text{L}$ )	144.6	368.8	159.0	456.6	157.2	435.8
MPV (fL)	6.71	9.60	6.90	10.01	6.84	9.80

A literature verification study was performed for the pediatric population. A total of 169 samples were collected from apparently healthy pediatric patients ranging from neonate to 21 years old within each pediatric subcategory (see table below). The results of the WBC, Lymph#, Gran#, RBC, HGB, HCT, MCV, and PLT parameters were compared to literature pediatric reference intervals from Mayo<sup>1</sup> and IOWA<sup>2,3,4</sup>.

Pediatric Category	Age Range
Neonate	Birth to 28 days
Infant	29 days to < 2 years old
Child	2 to < 12 years old
Adolescent	12 to < 18 years old
Transitional adolescent	18 to $\leq$ 21 years old

1. Mayo, Mayo Clinic –Mayo Medical Laboratories. Rochester 2014 Interpretive Handbook. 2014 Mayo Foundation for Medical Education and Research (MFMER).
2. Nathan, David G. and Oski, Frank A. *Hematology of Infancy and Childhood*. 1987.
3. Lanzkowsky, Philip. *Pediatric Hematology-Oncology: a Treatise for the Clinician*. New York: McGraw-Hill, 1980.
4. Miller, Denis R., et al. *Blood diseases of Infancy and Childhood*. St. Louis: Mosby, 1984.

**K. Proposed Labeling:**

The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

**L. Conclusion:**

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.