

**510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION  
DECISION SUMMARY  
DEVICE ONLY TEMPLATE**

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

K033747

**B. Purpose for Submission:**

To obtain original clearance using traditional 510(k) for this new assay.

**C. Analyte:**

Creatine Kinase MB isoenzyme (CK-MB)

**D. Type of Test:**

Immunochromatographic fluorescence immunoassay

**E. Applicant:**

RESPONSE BIOMEDICAL CORP.

**F. Proprietary and Established Names:**

RAMP CK-MB ASSAY

**G. Regulatory Information:**

1. Regulation section:  
21CFR §862.1215 -Creatine phosphokinase/creatin kinase or isoenzymes test system.
2. Classification:  
2
3. Product Code:  
JHX
4. Panel:  
CH

**H. Intended Use:**

1. Indication(s) for use:  
The RAMP CK-MB Assay is a quantitative immunochromatographic test indicated for use as an in vitro diagnostic product used with the RAMP Clinical Reader to measure CK-MB levels in EDTA whole blood. Measurement of CK-MB aids in the rapid diagnosis of acute myocardial infarction (AMI).
2. Special condition for use statement(s):  
The RAMP CK-MB Assay is not intended to monitor reperfusion patients. The RAMP CK-MB Assay is intended to be used only to prioritize patient management for those suspected of AMI.
3. Special instrument Requirements:  
RAMP® Clinical Reader

**I. Device Description:**

The RAMP CK-MB Assay is a quantitative immunochromatographic test for the determination of CK-MB levels in EDTA whole blood. Diluted EDTA whole blood is added to the sample well of the Test Cartridge which houses the immunochromatographic test strip. The red blood cells are retained in the sample pad, and the separated plasma migrates along the strip. Fluorescent-dyed latex particles coated with anti-CK-MB antibodies bind to CK-MB, if present in the sample. As the sample migrates along the strip, CK-MB bound particles are immobilized at the detection zone, and additional particles are immobilized at the internal control zone.

The RAMP Clinical Reader then measures the amount of fluorescence emitted by the complexes bound at the detection zone and at the internal control zone. Using a ratio between the two fluorescence values, a quantitative reading is calculated.

**J. Substantial Equivalence Information:**1. Predicate device name(s):

Immunoassay: Triage Cardiac Panel<sup>®</sup>; CK-MB Assay (K973126) which is currently being marketed by Biosite Diagnostics, Inc.

Immunoassay: Dimension<sup>®</sup> RxL Mass Creatine Kinase MB Isoenzyme Flex<sup>®</sup>, (K970343) which is currently being marketed by Dade Behring Inc.

2. Predicate K number(s):

K973126

K970343

3. Comparison with predicate:

The RAMP CK-MB Assay, Triage Cardiac Panel (Triage) - CK-MB; and Dade Dimension RxL (Dimension) Creatine Kinase MB Isoenzyme (CK-MB) Flex Assays are for the quantitative measurement of CK-MB in human whole blood (RAMP and Triage) or plasma (Triage and Dimension). All three immunoassays utilize the binding of CK-MB to specific antibodies and utilize light in their respective detection systems. Both the RAMP and Triage assays measure light production from a fluorescence reaction using a fluorometer while the Dimension measures the amount of colored product produced which is directly proportional to the concentration of CK-MB present in the patient sample. Both the RAMP CK-MB and the Triage CK-MB are quantitative immunochromatographic tests, whereas the Dimension CK-MB test is a sandwich enzyme immunoassay.

An additional minor difference is that while both the RAMP CK-MB and the Dimension CK-MB assay are single tests for CK-MB determination, the Triage Cardiac Panel consists of three tests, CK-MB, Troponin I, and Myoglobin.

<b>Similarities</b>		
<b>Item</b>	<b>Device</b>	<b>Predicate</b>
Intended Use	The RAMP CK-MB Assay is a quantitative immunochromatographic test indicated for use as an in vitro diagnostic product used with the RAMP Clinical Reader to measure Creatine Kinase MB (CK-MB) levels in EDTA whole blood. Measurement of CK-MB aids in the rapid diagnosis of acute myocardial infarction (AMI).	Triage Cardiac Panel is a fluorescence immunoassay used for the quantitative determination of TnI, Creatine Kinase MB and Myoglobin in heparinized whole blood and plasma specimens. The test is used as an aid in the diagnosis of myocardial infarction.
Test Principle	Immunochromatographic fluorescence immunoassay	Same
Target Population	Suspected Acute Myocardial Infarction	Same
Test Procedure	Add sample to Test Cartridge	Same
Automated Processing	Instrument transport of Test Cartridge within reader only moving step  No internal liquid handling  One step immunochromatography assay requiring no additional washes	Same
Read Results	Read results on screen	Same
Test Time	12 minutes after Test Components come to room temperature	15 – 18 minutes after Test Device comes to room temperature
Waste Handling	Dispose of Test Cartridge as per correct institutional biohazard procedure	same
Automated Analysis	Yes	Yes
Self Contained	Yes	Yes
Portable	Yes	Yes
Battery Operation Available	Yes, rechargeable	Yes, replaceable
Special Instrumentation Required	Yes; RAMP Clinical Reader	Yes; Triage Meter

<b>Differences</b>		
<b>Item</b>	<b>Device</b>	<b>Predicate</b>
<b>Sample Preparation</b>	Use provided pipette to dilute sample 1/8 in provided pre-measured diluent vial	Use special provided transfer pipette to withdraw sample to the level of the lower bulb
<b>Specimen Type</b>	Whole anticoagulated blood (EDTA)	Whole anticoagulated blood or plasma (heparin)
<b>Specimen Storage:</b>		
Ambient	up to 2 hours	not recommended
2-8 °C	up to 2 days	up to 24 hours
-20 °C	not recommended	for longer term storage (plasma only)

**K. Standard/Guidance Document Referenced (if applicable):**

None Referenced

**L. Test Principle:**

Immunochemographic fluorescence immunoassay

**M. Performance Characteristics (if/when applicable):**1. Analytical performance:a. *Precision/Reproducibility:*

The intra-assay and the inter-assay precision of the RAMP CK-MB Assay were determined by one operator assaying duplicates of three standards (7.19, 14.29 and 25.06 ng/mL CK-MB) twice each day over 10 days. The mean, standard deviation and % CV were calculated for the predicted CK-MB at each concentration.

<b>Precision</b>	<b>Standards</b>		
	<b>CK-MB Mean Concentration (ng/mL)</b>		
	<b>7.19</b>	<b>14.29</b>	<b>25.06</b>
Within Run Precision	7.7%	7.8%	4.8%
Total Precision	8.6%	8.5%	6.9%

b. *Linearity/assay reportable range:*

CK-MB antigen concentrations of 2.5, 5.0, 10.0, 20.0, 40.0 and 60.0 ng/mL were prepared in normal donor EDTA blood. The linearity and percent recovery were determined by assaying five replicates of each concentration and baseline. The mean, standard deviation and %CV were calculated for the predicted CK-MB at each concentration. Linear regression analysis of actual CK-MB concentration versus expected CK-MB concentration resulted with an R = 0.999 and a slope of 1.05 with an offset of 0.098. The

recovery of spiked CK-MB antigen at the six concentrations ranged from 99 to 111% with an average of 106%.

c. *Traceability (controls, calibrators, or method):*

Each RAMP CK-MB kit includes a Lot Card that is individually packaged in an anti-static pouch. The Lot Card provides information specific to the kit Test Cartridge lot, including lot number, expiration date, and standard curve information. Insertion of the Lot Card into the Reader is the only calibration necessary for each lot of reagents.

Quality Controls are provided in every Test Cartridge, which serve as built-in performance controls for routine QC requirements. A comparison of this control and the assay result indicate that sufficient sample was applied to the test device, that unbound fluorescent label washed sufficiently from the detection zone, and the device was inserted and read properly by the instrument. This control also prevents a used cartridge from being re-run by the reader. Antibody quality, system function and assay timing are checked on each assay run. An unacceptable result from the control displays a warning message on the instrument indicating that the test should be repeated.

It is recommended that a commercial external control material be run in the RAMP CK-MB Assay weekly, or in conformance with regulatory or accreditation requirements. To run a QC sample, follow the instructions under the SAMPLE ANALYSIS PROCEDURE section. Treat the control as a whole blood sample.

d. *Detection limit:*

The lower limit of detection (LLD) is defined as the analyte concentration corresponding to the mean (n=20) plus 2 standard deviations of the zero. The LLD is 0.32 ng/mL CK-MB. CK-MB levels in excess of 80 ng/mL are reported as greater than (>) 80 ng/mL.

e. *Analytical specificity:*

Potentially cross-reactive substances were evaluated by spiking different concentrations into blood. CK-MM up to 50,000 ng/mL and CK-BB up to 1000 ng/mL appear to have no cross-reactivity with the RAMP CK-MB Assay. Human anti-mouse antibodies (HAMA), human anti-goat antibodies (HAGA), human anti-rabbit antibodies (HARA) and Rheumatoid Factor (RhF) appear to have limited cross-reactivity with the RAMP CK-MB Assay.

Potentially interfering substances were evaluated by spiking different concentrations of potential interferents in blood with CK-MB added. Different blood samples were used for each potential interferent. Interference was evaluated by calculating the CK-MB concentration

of potential interferent-spiked blood, expressed as a percentage of the CK-MB concentration of the unspiked (no potential interferent) blood sample. No evidence of cross-reactivity or interference was observed for hemoglobin, triglyceride, bilirubin, cholesterol or heparin at levels of very high physiological concentrations, up to 2000 mg/dL, 3000 mg/dL, 80 mg/dL, 500 mg/dL, and 104 IU/mL, respectively. No trend was observed in the CK-MB predictions as the concentration of potential interferent was increased.

f. *Assay cut-off:*  
0.32 ng/mL (LLD)

2. Comparison studies:

a. *Method comparison with predicate device:*

Three hundred and sixty-five (365) subjects were enrolled in the Method Comparison Study. Of these subjects, 180 were normal individuals (84 males and 96 females) and 185 were suspected of acute myocardial infarct (AMI) based on the individual hospital criteria (115 males and 70 females). EDTA and heparin whole blood samples were obtained for each of these subjects. All normal subjects were consented. Waste samples were used for the subjects suspected of AMI. An aliquot of the whole blood was taken for the RAMP CK-MB Assay and heparinized plasma was prepared for the Dade Behring Dimension CK-MB Assay. The data was winsorized to account for the differing reportable ranges and two outliers were removed from the suspect AMI samples. The correlation data is presented in the table below.

<b>Population</b>	<b>n</b>	<b>Sy.x</b>	<b>Slope y =</b>	<b>Interce pt</b>	<b>R</b>
Combined Populations	363	3.11	0.966	0.600	0.986
Suspect AMI Subjects	183	4.28	0.955	1.207	0.984

The sensitivity, specificity, and percent agreement of all samples were calculated comparing a clinical cutoff of 6.0 ng/mL CK-MB for the RAMP CK-MB Assay to the published clinical cutoff of 5.0 ng/mL CK-MB presented in the Dade Dimension package insert. The data is presented in the table below.

	<b>n</b>	<b>(%)</b>	<b>s.e.</b>	<b>95 % CI</b>	
Sensitivity	101	96.04	1.94	92.24	99.84
Specificity	264	97.73	0.92	95.93	99.53
PV+	103	94.18	2.31	89.65	98.70
PV-	262	98.47	0.76	96.99	99.96
Concordance	365	97.26	0.85	95.59	98.94

- b. Matrix comparison:*  
Not Applicable
3. Clinical studies:
- a. Clinical sensitivity:*  
Not Applicable
- b. Clinical specificity:*  
Not Applicable
- c. Other clinical supportive data (when a and b are not applicable):*  
Not Applicable
4. Clinical cut-off:  
Not Applicable
5. Expected values/Reference range:  
One hundred and eighty (180) normal individuals were enrolled in the Expected Values Study. RAMP CK-MB expected normal values ranged from 0.00 to 3.74 ng/mL CK-MB. The percentile ranking is presented in the table below.

<b>Percentile</b>	<b>ng/mL</b>
5 <sup>th</sup> (LLN)	0.00
50 <sup>th</sup>	0.78
90 <sup>th</sup>	2.87
95 <sup>th</sup> (ULN)	3.74
97.5 <sup>th</sup>	4.99

The RAMP CK-MB Assay is not intended to monitor reperfusion patients. The RAMP CK-MB Assay is intended to be used only to prioritize patient management for those suspected of AMI.

**N. Conclusion:**

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