

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

A. 510(k) Number:

k033055

B. Analyte:

Glucose

C. Type of Test:

Quantitative electrochemical assay

D. Applicant:

Diamond Diagnostics / Mission Diagnostics

E. Proprietary and Established Names:

Mission Diagnostic Glucose Reagent for Beckman Synchron CX[®] & CX[®] Delta Systems

F. Regulatory Information:

1. Regulation section:
21 CFR § 862.1345, Glucose Test System
2. Classification:
Class II
3. Product Code:
CGA, glucose oxidase glucose test system
4. Panel:
Clinical Chemistry (75)

G. Intended Use:

1. Indication(s) for use:

Mission Glucose Reagent is intended for the quantitative determination of glucose in serum, plasma, cerebrospinal fluid (CSF), and urine on the Beckman Synchron CX[®] & CX[®] Delta Systems.

Glucose measurements are used in the diagnosis and treatment of carbohydrate metabolism disorders including diabetes mellitus, neonatal hypoglycemia, idiopathic hypoglycemia, and pancreatic islet cell carcinoma.

2. Special condition for use statement(s):

Intended to serve as a direct replacement to like-named products manufactured by the Original Equipment Manufacturer (OEM).

3. Special instrument Requirements:
Beckman Synchron CX[®] & CX[®] Delta Systems

H. Device Description:

The Mission Diagnostic Glucose Reagent for Beckman Synchron CX[®] & CX[®] Delta Systems is a reagent for use with the Beckman Synchron CX[®] & CX[®] Delta Systems. The reagent is packaged in 500 mL quantities, and contains 590 U/mL glucose oxidase, 10% denatured alcohol, 0.04 mol/L potassium iodide, buffers, ammonium molybdate, and preservatives.

I. Substantial Equivalence Information:

1. Predicate device name(s):
Beckman PN 443355
2. Predicate K number(s):
K942676, K864236
3. Comparison with predicate:

This reagent is intended to be a secondary reagent. The device and its predicate have the same intended use, composition, packaging quantities and dimensions, storage conditions, and shelf life.

J. Standard/Guidance Document Referenced (if applicable):

NCCLS Guidance document EP5A, Evaluation of Precision Performance of Clinical Chemistry Devices

NCCLS Guidance document EP9A2, Method Comparison and Bias Estimation Using Patient Samples

K. Test Principle:

Glucose concentration is determined by an oxygen rate method employing an oxygen Electrode. Electronic circuits determine the rate of oxygen consumption, which is directly proportional to the concentration of glucose in the sample.

L. Performance Characteristics (if/when applicable):

1. Analytical performance:
 - a. *Precision/Reproducibility*

Within run precision was measured by assaying serum and urine controls in triplicate 6 times to lead to N = 18 (CSF, N = 15). Total precision included samples run in triplicate 2 to 5 runs per day for 4 days (N = 51 serum, 35 urine, 32 CSF). Results are summarized below:

Sample	Mean mg/dL	Mean within run SD N=3	Total Run SD	Total Mean mg/dL	Total SD – all runs	% CV	N
DControl 1	90	0.6	1.7	93	4.2	4.5	51
DControl 2	305	1.5	0.3	319	13.1	4.1	51
Urine 1 Cntrl	43	0.6	0.3	43	2.0	4.6	35
Urine 2 Cntrl	286	2.2	2.5	295	10.8	3.7	57
CSF1 Cntrl	53	1.4	2.9	52	2.6	5.0	32
CSF2 Cntrl	92	1.1	4.9	90	3.9	4.4	32

Additional data were submitted as follows. Data was collected per NCCLS EP5-A. Samples were assayed in duplicates twice a day for 20 days.

	N	Mean mg/dL	Within-run SD	W/in run %CV	Total SD	Total %CV
CSF Control 1	80	59	0.8	1.3	3.8	6.3
CSF Control 2	80	30	1.5	5.0	3.0	10.1
Serum Control 1	80	89	2.1	2.3	6.0	6.7
Serum Control 2	80	308	2.2	0.1	21.7	7.0
Urine Control 1	80	45	1.0	2.3	2.3	5.1
Urine Control 2	80	287	2.4	0.8	14.4	5.0

b. Linearity/assay reportable range:

The following useable range was specified by the sponsor:

0.6 – 25 mmol/L (or 10 – 450 mg/dL) for serum, plasma, urine, or CSF.

The CX® Systems Over Range Detection and Correction (ORDAC) function will accommodate samples with glucose concentrations between 25 - 50 mmol/L (450 – 900 mg/dL). Users are instructed to dilute these samples that exceed the high end of the analytic range with saline and reanalyze. (an integrated function of the instrument, K942676, K864236)

Percent recovery was evaluated on linearly diluted samples. Pooled serum, urine, or CSF samples were spiked to achieve glucose concentrations in the upper end of the measurement range of the assay. These samples were then diluted, expected concentrations were calculated and each pool was measured using both Mission reagents and the predicate reagents. Results are summarized below.

	Reagents	Range of % Recovery	Mean Recovery
Serum 30 – 835 mg/dL	Mission	83.3 – 115.4	103 %
	Predicate	83.3 – 117.5	103 %
Urine 10 – 300 mg/dL	Mission	88 – 120	101 %
	Predicate	87 – 110	97 %
CSF 25 – 100 mg/dL	Mission	88 – 98	94 %
	Predicate	88 - 100	95 %

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

Not applicable in this submission. The use of appropriate commercially available control materials is recommended.

d. Detection limit:

Serum samples with low glucose concentrations were tested in triplicate over 13 runs. Results are summarized below.

Mean (mg/dL)	SD	%CV
41.9	1.52	3.6
14.7	0.75	5.1
9.8	0.95	9.7
3.6	1.35	37.6
2.0	0.65	32.4

The sponsor claims a functional sensitivity of 10 mg/dL glucose (the lowest level tested with a CV less than 20%).

e. Analytical specificity:

Whole blood samples are not recommended. Lipemic samples >+3 should be ultracentrifuged and the analysis performed on the supernatant fraction. The sponsor refers the user to literature references for other interferences caused by drugs and diseases.

5.0 mg/dL Hydroxyethyl starch may cause a result increase of 3 mg/dL.

20 mmol/L Glutathione may cause a result increase of 31 mg/dL.

The following anticoagulants or chemical additives are compatible with this method:

Anticoagulants	Acceptable level
Sodium Citrate*	3.5 mg/mL
EDTA	4.0 mg/mL
Ammonium Heparin	45 U/mL
Lithium Heparin	45 U/mL
Sodium Heparin	45 U/mL
Lithium Iodoacetate	1.5 mg/mL

* specimens collected with liquid sodium citrate will exhibit a decrease in value due to dilution.

f. *Assay cut-off:*
Not applicable.

2. Comparison studies:

a. *Method comparison with predicate device:*

Serum and Urine controls were assayed six times in triplicate using both the Mission and predicate reagents (N = 18).

	Mission Reagent				Predicate Reagent			
	Mean (mg/dL)	Within run SD	Total SD	% CV	Mean (mg/dL)	Within run SD	Total SD	% CV
DControl1	90	0.6	1.7	0.6	90	0.6	2.3	0.8
DControl2	305	1.5	0.3	0.4	293	1.5	0.3	0.4
Urine 1	43	0.6	0.3	0.8	44	1.0	0.5	1.1
Urine 2	286	2.2	2.5	0.9	279	2.4	1.2	0.4

Comparisons of spiked serum, CSF, or urine samples or controls using the Mission reagent and the predicate reagent yielded the following correlations:

Serum:

- Range 0 – 400 mg/dL: $y = 1.09x - 2.52$, $R^2 > 0.999$
- Range 0 – 500 mg/dL: $y = 1.08x - 1.78$, $R^2 = 0.999$
- Range 0 – 780 mg/dL: $y = 1.08x - 2.37$, $R^2 = 0.999$

CSF:

- Range 23 – 90 mg/dL: $y = 0.96x + 1.50$, $R^2 = 0.997$

Urine:

- Range 20 – 294 mg/dL: $y = 1.05x - 4.80$, $R^2 = 0.999$

Additional data were submitted. Tests were performed per NCCLS EP9-A2 and analyzed by least squares regression.

Fifty (50) serum samples were spiked or diluted and tested in triplicate with the Mission reagents and the predicate reagents.

Range = 0 to 900 mg/dL

Mission = 1.038 (Predicate) – 2.31

$r^2 = 0.998$

95% CI at 70 mg/dL - 66.4 to 74.3 mg/dL

95% CI at 105 mg/dL – 102.3 to 111.0 mg/dL

Fifty-seven (57) urine samples were spiked or diluted and tested in triplicate with the Mission reagents and the predicate reagents.

Range = 1 to 293 mg/dL
 Mission = 1.022 (Predicate) + 1.067
 $r^2 = 0.998$
 95% CI at 1 mg/dL – 1.18 to 2.99 mg/dL
 95% CI at 15 mg/dL – 15.3 to 17.4 mg/dL

Thirty-six (36) CSF samples were spiked or diluted and tested in triplicate with the Mission reagents and the predicate reagents.

Range = 8 to 118 mg/dL
 Mission = 1.014 (Predicate) – 0.920
 $r^2 = 0.997$
 95% CI at 40 mg/dL – 37.7 to 41.5 mg/dL
 95% CI at 70 mg/dL – 67.6 to 72.5 mg/dL

b. Matrix comparison:

Not applicable. Performance data was submitted for all matrices.

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:

Sample Type	Units (mmol/L)	SI Units (mg/dL)
Serum or Plasma	3.9 – 5.8	70 - 105
CSF	2.2 – 3.9	40 - 70
Urine	0.06 – 0.8	1- 15

The sponsor states that normal fasting glucose is between 70 and 110 mg/dL. Diabetes (hyperglycemia) is diagnosed when patient glucose levels are: fasting glucose > 126 mg/dL, serum glucose of > 200 mg/dL, or other symptoms. Hypoglycemia is diagnosed when patient glucose levels are < 60 mg/dL.

The sponsor states that these values are intended as a reference, and that no adjustments have been made for age, sex, or dietary differences. Each laboratory should establish a reference range based on their patient population.

M. Conclusion:

I recommend that the Mission Diagnostic Glucose Reagent for Beckman Synchron CX® & CX® Delta Systems is substantially equivalent to the legally marketed predicate device.