

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

A. 510(k) Number:

k040115

B. Analyte:

Magnesium

C. Type of Test:

Quantitative enzymatic assay

D. Applicant:

Abaxis, Inc.

E. Proprietary and Established Names:

Piccolo[®] Magnesium test system

F. Regulatory Information:

1. Regulation section:
21 CFR § 862.1495, Magnesium test system
2. Classification:
Class I, reserved
3. Product Code:
JGJ Photometric method, magnesium
4. Panel:
Clinical Chemistry (75)

G. Intended Use:

1. Indication(s) for use:

The Piccolo Magnesium test system is intended to be used for the in vitro quantitative determination of magnesium in heparinized whole blood, heparinized plasma, or serum in a clinical laboratory setting or point of care location.

Magnesium measurements are used in the diagnosis and treatment of hypomagnesemia and hypermagnesemia.

2. Special condition for use statement(s):

For professional use only

3. Special instrument Requirements:

Piccolo Point-of-Care Chemistry Analyzer

H. Device Description:

The Piccolo[®] Magnesium assay is contained within the Renal Function panel plus Reagent Disk. The disk is an 8 cm diameter single-use device that contains chambers for reagents along the outer edge of the disk and chambers for the sample and dilution of sample. Sample is placed in the disk, the disk is placed into the analyzer, and the sample assay is automatic.

I. Substantial Equivalence Information:

1. Predicate device name(s):
Magnesium slides on the Vitros 950 Chemistry System, Johnson and Johnson Clinical Diagnostics
2. Predicate K number(s):
K861386
3. Comparison with predicate:
The device and its predicate share the same intended use and are both for professional use only.

Similarities		
Item	Device	Predicate
Sensitivity	0.1 mg/dL	0.2 mg/dL
Reaction Temperature	37°C	37°C
Assay Range	0.1 – 8.0 mg/dL	0.2 – 10.0 mg/dL
Differences		
Item	Device	Predicate
Sample Type	Heparinized whole blood, heparinized plasma, and serum	Heparinized plasma, serum, and urine
Reagents	Dry test-specific reagent beads	Dry multi-layered, analytical element coated on a polyester support. Contains 1,2-bis(o-aminophenoxy)ethane-N,N,N',N'-tetraacetic acid (Ca ²⁺ chelator) and 1,5-bis(2-hydroxy-3,5-dichlorophenyl)-3-cyanoformazan (dye).
Calibration	Each disk is bar coded with factory-calibrated lot-specific data	Calibrated periodically using vendor-supplied calibrators
Sample Size	Approximately 100 µL	10 µL

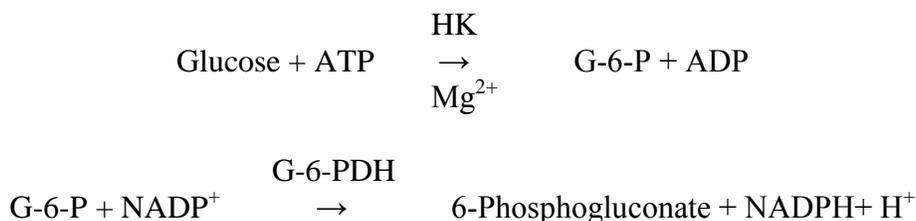
J. Standard/Guidance Document Referenced (if applicable):

- In Vitro Diagnostic Devices: Guidance for the Preparation of 510(k) Submissions

- NCCLS Guideline EP9-A – Method Comparison and bias estimation using patient samples
- NCCLS Guideline EP5-A – Evaluation of precision performance of clinical chemistry devices
- NCCLS Guideline EP18-P – Quality management for unit-use testing
- NCCLS Guideline EP6-P – Evaluation of the linearity of quantitative analytical methods
- NCCLS Guideline EP7-P – Interference testing in clinical chemistry
- NCCLS Guideline C28-A2 – How to define and determine reference intervals in the clinical laboratory

K. Test Principle:

Appropriate sample types are heparinized whole blood, heparinized plasma, or serum. If whole blood is used, the device is designed to separate the blood cells from the plasma. The plasma is then diluted and introduced into the sample cuvette which contains lyophilized reagents. Magnesium concentration is measured by a hexokinase (HK) activation method. The reaction proceeds as follows (G-6-P = Glucose-6-Phosphate, G-6-PDH = Glucose-6-Phosphate Dehydrogenase):



The hexokinase reaction is rate limiting, therefore the rate of NADPH production is proportional to the concentration of magnesium in the sample. NADPH concentration is measured spectrophotometrically at 340 nm and 405 nm.

L. Performance Characteristics (if/when applicable):

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

Precision was evaluated per NCCLS EP5-A using two commercially available human serum-based controls. Samples were run in duplicate on two instruments twice per day for 5 days at each of two sites. Data from both sites were combined to yield n = 80 per control level. Results are summarized below (units = mg/dL).

	Within Run			Total		
	Mean	SD	% CV	Mean	SD	% CV
Control 1	1.9	0.03	1.7 %	1.9	0.06	3.4 %
Control 2	3.9	0.04	1.0 %	3.9	0.10	2.6 %

- b. *Linearity/assay reportable range:*

Human serum was spiked with magnesium and diluted with magnesium-free serum for a total of 5 samples ranging from 0 to 7.9 mg/dL. Each sample was assayed in quadruplicate on four different analyzers. Results are summarized below.

$$\begin{aligned}\text{Observed} &= 0.992(\text{Expected}) - 0.05 \\ R^2 &= 0.998 \\ r &= 0.999\end{aligned}$$

The assay's reportable range is 0.1 – 8.0 mg/dL.

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

The reagent disks are calibrated at the manufacturer using human serum based pools that are spiked with magnesium to 6 levels covering the reportable range of the assay. The pools are verified against a NIST standard reference material (No. 909b, Human Serum) using a commercially available magnesium assay. The pools are then analyzed on the Piccolo analyzer to determine the enzymatic rate at each level, and a calibration curve is generated from that data. The calibration information is bar-encoded on each reagent disk. No user calibration is required.

Quality control beads (for both stability and chemistry) are included on each reagent disk and automatically run with each assay. The information from this quality control analysis is stored with the test results and can be printed by the user. In addition, users can run commercially available control materials or pseudospecimens to verify assay performance.

d. Detection limit:

Analytical sensitivity was determined by assaying 20 replicates of magnesium-free serum across 20 analyzers. The sensitivity was determined as two standard deviations above the 0 mg/dL sample. The analytical sensitivity is 0.1 mg/dL.

e. Analytical specificity:

Serum pools (at least 4 test pools containing different levels of the potential endogenous interferents and a control pool) were prepared according to NCCLS EP7-P. Five replicates of each pool were assayed and compared to the control pool. Below are shown the levels of the endogenous substance that exhibit <10% interference. Samples with values above these levels will be reported as “HEM”, “LIP”, or “ICT” on the result card.

Substance	Level with <10% interference (mg/dL)
Hemoglobin	1000
Bilirubin	50
Triglycerides	1500

Interference from exogenous substances was examined as for endogenous substances above. Concentrations of the 35 substances tested that did not induce >10% interference are presented in the package insert.

f. Assay cut-off:
Not applicable

2. Comparison studies:

a. Method comparison with predicate device:

Serum samples were collected from patients and assayed within 30 minutes by both the device and the predicate. Four frozen samples were also used to provide additional abnormal values to cover the range yielding 67 total samples. Each sample was tested in duplicate on the predicate and on one of four Piccolo analyzers. Both linear and Deming regression analysis was performed for comparison. Summary data is as follows (Piccolo range = 0.9 – 7.7 mg/dL, Predicate range = 0.9 – 7.7 mg/dL).

Linear Regression: $y = 1.002x + 0.01$
 $R^2 = 0.993$
 $r = 0.996$

Deming Regression: $y = 1.003x + 0.01$
 $R^2 = 0.993$
 $r = 0.996$

b. Matrix comparison:

Whole blood (heparinized), plasma (processed from the whole blood samples), and serum samples were collected for 10 individuals and tested in replicates of 8. The results were compared using descriptive statistics, plots, correlation analysis, and non-parametric tests of association. There is a statistically significant correlation among all sample types, indicating equivalency.

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):

Although this is a POC analyzer, POC studies were not needed to support this 510(k), as the procedures followed to analyze magnesium are not different from those previously evaluated in POC studies.

4. Clinical cut-off:
Not applicable

5. Expected values/Reference range:

The sponsor assayed 61 samples from healthy individuals to verify the reference range published in the predicate device labeling (method correlation $y = 1.002x + 0.01$). Below are the results from this analysis as well as the predicate's reference range. Because the ranges are similar and the two devices show good correlation, the sponsor reports the predicate range in the labeling for this device.

Method	Reference interval
Predicate	1.6 – 2.3 mg/dL
Piccolo	1.7 – 2.2 mg/dL

M. Conclusion:

I recommend that the Piccolo[®] Magnesium test system is substantially equivalent to the legally marketed predicate device.