510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY TEMPLATE

A. 510(k) Number:

k173294

B. Purpose for Submission:

New device

C. Measurand:

Magnesium

D. Type of Test:

Quantitative, enzymatic assay

E. Applicant:

Abbott Laboratories

F. Proprietary and Established Names:

Magnesium

G. Regulatory Information:

1. Regulation section:

   CFR 862.1495, Magnesium test system

2. Classification:

   Class I, reserved

3. Product code:

   JGJ

4. Panel:

   Clinical Chemistry (75)

H. Intended Use:

1. Intended use(s):

   See indications for use below.

2. Indication(s) for use:

   The Magnesium assay is used for the quantitation of magnesium in human serum or plasma on the ARCHITECT c8000 System.

   Magnesium measurements are used in the diagnosis and treatment of hypomagnesemia (abnormally low plasma levels of magnesium) and hypermagnesemia (abnormally high plasma levels of magnesium).

3. Special conditions for use statement(s):

   For *in vitro* diagnostic use, only.

   For prescription use only.

4. Special instrument requirements:

   ARCHITECT c8000 Analyzer

I. Device Description:

The magnesium assay consists of 2 ready to use reagent solutions. The R1 reagent contains isocitrate dehydrogenase at a concentration of 2.2 U/mL and D-isocitrate potassium salt with a concentration of 1.47 mg/mL. The R2 reagent contains NADP with a concentration of 8.37 mg/mL.

J. Substantial Equivalence Information:

1. Predicate device name(s):

   Roche Magnesium Gen.2

2. Predicate 510(k) number(s):

   k983416

3. Comparison with predicate:

Similarities		
Item	Candidate Device Magnesium (k173294)	Predicate Device Roche Magnesium Gen. 2 (k983416)
Intended Use	For the quantitative determination of magnesium in serum or plasma.	Same
Analysis Medium	Aqueous solution	Same
Calibrators	Two levels	Same

Differences		
Item	Candidate Device Magnesium (k173294)	Predicate Device Roche Magnesium Gen. 2 (k983416)
Device Technology	Enzymatic quantitative method	Colorimetric photometric ally method
Assay Range Serum/Plasma	0.60 to 9.50 mg/dL	0.243 – 4.86 mg/dL 1:2 dilution up to 9.72 mg/dL
Sample types	Serum and plasma	Serum, plasma, urine
Controls	Two levels	Four levels
Traceability	NIST SRM 956	AAS method

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

- CLSI EP17-A2 Evaluation *of Detection Capability for Clinical Laboratory Measurement Procedures; Approved Guideline—Second Edition*
- CLSI EP06-A *Evaluation of the Linearity of Quantitative Measurement Procedures: A Statistical Approach; Approved Guideline*
- CLSI EP05-A2 *Evaluation of Precision Performance of Quantitative Measurement Methods; Approved Guideline—Second Edition*
- CLSI EP17-A2, *Interference Testing in Clinical Chemistry; Approved Guideline-Second Edition*

L. Test Principle:

Magnesium present in the sample is a cofactor in an enzymatic reaction with isocitrate dehydrogenase. The rate of increase in absorbance at 340 nm, due to the formation of NADPH, is directly proportional to the magnesium concentration.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:

a. Precision/Reproducibility:

Precision was evaluated according to the CLSI EP5-A2 guideline. Precision testing included 2 levels of control materials (Serum Control Level 1 and 2) and 4 human serum pools (A, B, C, D). Each sample was tested in 2 replicates per run, 2 runs per day for 20 days for a total of 80 replicates per sample. The results from the precision study are summarized in the table that follows:

Sample	n	Mean (mg/dL)	Within Run		Total	
			SD	%CV	SD	%CV
Control 1	80	1.75	0.019	1.1	0.025	1.4
Control 2	80	4.15	0.030	0.7	0.040	1.0
Pool A	80	0.62	0.019	3.0	0.021	3.4
Pool B	80	1.90	0.019	1.0	0.023	1.2
Pool C	80	5.06	0.039	0.8	0.047	0.9
Pool D	80	9.27	0.051	0.5	0.076	0.8

b. Linearity/assay reportable range:

Linearity was evaluated according to CLSI EP06 guideline. The linearity of the Magnesium assay was evaluated by preparing a series of 12 sample pools with analyte concentrations of 0.30, 0.49, 0.68, 1.07, 1.83, 3.35, 4.88, 6.40, 7.93, 9.45, 10.98, and 12.50 mg/dL. Samples were tested in four replicates with two reagent lots on the ARCHITECT c8000 System. The linear regression results of a representative sample set are as follows:

$y = 1.04 x - 0.14$, $r = 1.00$

The linearity study supports the claimed measuring range of 0.60 - 9.50 mg/dL.

Manual dilution study:

Three serum pools were prepared using human serum and magnesium chloride at to achieve magnesium concentrations of 8, 15, and 25 mg/dL. Each sample was evaluated without dilution (neat) and after 1:2 and 1:5 manual dilution. Dilutions were prepared using 0.8% and 0.90% (NaCl) saline. These diluted samples were tested at a minimum of seven replicates using one lot of reagent. All the results obtained are within ±7.5% of the expected value. The results of the dilution study support the sponsor's labeling claims that samples with magnesium values exceeding 9.5 mg/dL may be diluted 1:2 or 1:5 using the manual dilution procedure.

c. *Traceability, Stability, Expected values (controls, calibrators, or methods):*

Traceability:

The assigned values for Chemistry Multiconstituent Calibrator are traceable to NIST SRM 956 reference material. The calibrator was previously cleared in k103403.

d. *Detection limit:*

Detection limit studies were carried out in accordance with the CLSI EP17-A2 guideline.

The limit of blank (LoB) was determined by running a blank sample in 10 replicates per run and 2 runs per day for 3 days using 2 reagent lots on one ARCHITECT c8000 System. The 95 percentile rank order was assigned as the LoB.

The limit of detection (LoD) was determined by running four low level samples which were tested in 10 replicates per run and 2 runs per day for 3 days using 2 reagent lots on one ARCHITECT c8000 System. LoD was calculated based on the following formula: LoB (mean) + 1.65 SD (low sample).

The limit of quantitation (LoQ) was determined by running four low level samples which were tested in 10 replicates per run and 2 runs per day for 3 days using 2 reagent lots on one ARCHITECT c8000 System. LoQ was defined as the lowest concentration that can be detected with an estimated total error of ≤ 15% or 0.3 mg/dL.

The results are summarized in the table below:

	mg/dL
LoB	0.03
LoD	0.05
LoQ	0.05

The detection limit studies study supports the claimed measuring range of 0.60 - 9.50 mg/dL.

e. *Analytical specificity:*

An interference study was performed based on CLSI EP07-A2 guideline. Interference effects were assessed by dose response and paired difference methods. Bias is defined as the difference in the results between the control sample (without interference) and the test sample (contains interferent) expressed in percent. Difference exceeding 7.5% is considered significant interference by the sponsor.

The highest concentration of substance tested that did not cause significant interference is summarized in the table below.

Substance	Highest concentration tested that did not show significant interference
Ascorbic acid	3 mg/dL
L-Dopamine	5 mg/dL
Conjugated Bilirubin	56.5 mg/dL
Unconjugated Bilirubin	60.9 mg/dL
Glucose	1199 mg/dL
Hemoglobin	250 mg/dL
Intralipid	2482 mg/dL
Calcium	28 mg/dL
Copper	6.5 µg/mL
Iron	641µg/dL
L-Dopamine	5.0 mg/dL
Triglyceride	3580 mg/dL
Zinc	4.3 µg/mL

The following drugs were tested and showed no interference at the concentrations indicated below using an acceptance criterion of bias not exceeding 7.5%.

Substance	Highest concentration tested that did not show significant interference
Sulfapyridine	300 mg/dL
Sulfasalazine	300 mg/dL
Temozolomide	20 mg/dL
Acetaminophen	241µg/mL
Ibuprofen	601µg/mL
Salicylic acid	71.96 mg/dL

f. Assay cut-off:

Not applicable.

2. Comparison studies:

a. Method comparison with predicate device:

A method comparison study was conducted in accordance with the CLSI EP09-A3 guideline. A total of 122 patient serum samples (111 native and 11 spiked serum samples) with magnesium concentrations of 0.65 to 9.00 mg/dL were evaluated with the magnesium assay (candidate device) versus the Roche Magnesium Gen.2 assay (predicate device). Testing was performed for 5 working days in three replicates using the magnesium assay and one replicate using the predicate device. The results were calculated using the first replicate of the candidate versus the single replicate of the predicate.

The results of the regression analysis are summarized in the table below:

N	Concentration Range Tested	Slope	Intercept	R
122	0.65– 9.00 mg/dL	0.95	-0.02	0.9979

b. Matrix comparison:

Results from serum glass tubes (the control) were compared to those from serum tube with gel-separator, sodium heparin plasma tube (without gel separator), lithium heparin plasma tube (without gel separator) and lithium heparin plasma tube with gel separator. A total of 40 matched sample pairs were analyzed spanning the measurement range of 0.60 to 9.50 mg/dL. All samples were tested in a minimum of 2 replicates using 1 reagent lot on the ARCHITECT c8000 System.

The following linear regression equation was obtained between the matrices generated by testing various tube types vs. control tube (serum).

Evaluation Tube	N	Slope	Intercept	Correlation Coefficient
Serum separator	40	0.986	0.040	0.9997
Sodium heparin	40	0.997	-0.003	0.9996
Lithium heparin	40	0.975	0.040	0.9996
Lithium heparin separator	40	0.964	0.068	0.9998

The results of the matrix comparison study support the sponsor's claim that samples from serum separator, sodium heparin, lithium heparin and lithium heparin separator tubes can be tested with this assay.

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:

Reference intervals are based on literature[1] (see table below). The sponsor recommends that each laboratory should determine its own reference range based upon its locale and population characteristics.

Serum/Plasma

	Range (mg/dL)
Newborn, 2 to 4 days	1.5 to 2.2
5 months to 6 years	1.7 to 2.3
6 to 12 years	1.7 to 2.1
12 to 20 years	1.7 to 2.2
Adults	1.6 to 2.6

[1]Wu AHB. *Tietz Clinical Guide to Laboratory Tests*. 4th ed. Philadelphia, P.A: WB Sauders; 2006: 706 -708.

N. Proposed Labeling:

The labeling is sufficient and it satisfies the requirements of 21 CFR Parts 801 and 809, as applicable.

O. Conclusion:

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