

**510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY AND INSTRUMENT COMBINATION TEMPLATE**

A. 510(k) Number:

k172232

B. Purpose for Submission:

New device

C. Measurand:

Sodium, potassium, chloride, and creatinine

D. Type of Test:

Quantitative, potentiometric, ion selective electrodes for sodium, potassium, and chloride
Quantitative, photometric/colorimetric method for creatinine

E. Applicant:

AMS Diagnostics

F. Proprietary and Established Names:

LIASYS 600 Electrolyte Measurement System, LIASYS 600 Creatinine reagent,
LIASYS 600

G. Regulatory Information:

Regulation	Classification	Product Code	Panel
21 CFR 862.1665 Sodium Test System	Class II	JGS	Clinical Chemistry (75)
21 CFR 862.1600 Potassium Test System	Class II	CEM	Clinical Chemistry (75)
21 CFR 862.1170 Chloride Test System	Class II	CGZ	Clinical Chemistry (75)
21CFR 862.1225 Creatinine Test System	Class II	CGX	Clinical Chemistry (75)
21 CFR 862.2160 Discrete photometric chemistry analyzer for clinical use	Class I	JJE	Clinical Chemistry (75)

H. Intended Use:

1. Intended use:

See Indications for use.

2. Indications for use:

The LIASYS 600 Electrolyte Measurement System is intended for the quantitative determination of sodium, chloride, and potassium in human serum. Sodium measurements are used in the diagnosis and treatment of aldosteronism (excessive secretion of hormone aldosterone), diabetes insipidus, adrenal hypertension, Addison's disease, dehydration, inappropriate antidiuretic hormone secretion, or other diseases involving electrolyte imbalance. Measurements of potassium are used to monitor electrolyte balance in the diagnosis and treatment of disease conditions characterized by low or high blood potassium levels. Chloride measurements are used in the diagnosis and treatment of electrolyte and metabolic disorders such as cystic fibrosis and diabetic acidosis.

The LIASYS 600 creatinine reagent is intended for the quantitative determination of creatinine in human serum. Packaged for the ease of use with LIASYS 600. Creatinine measurements are used in the diagnosis and treatment of renal diseases, in monitoring renal dialysis, and as a calculation basis for measuring other urine analytes.

The LIASYS 600 is a random access, computer controlled, standalone clinical analyzer intended for the in-vitro determination of analytes in human serum.

3. Special conditions for use statements:

For prescription use only.

4. Special instrument requirements:

LIASYS 600

I. Device Description:

The LIASYS 600 sodium, potassium, and chloride assays are supplied through an ISE (ion specific electrode) module installed onto the LIASYS 600 instrument. Internal solution composition: sodium 140 mmol/L, potassium 4.0 mmol/L, and chloride 125 mmol/L.

The LIASYS 600 creatinine assay is supplied as reagent kit in a single vial with ready to use liquid. Reagent concentrations: 10 mM picric acid, 250 mM sodium hydroxide 250 mM; pH 12.8 to 13.2.

The LIASYS 600 is a fully automated, random access, analyzer for clinical chemistry assays.

J. Substantial Equivalence Information:

1. Predicate device names:

LIASYS Sodium, potassium, and chloride - k080468

Roche Reagent for Creatinine - k941837

LIASYS 450 SAT 450 - k113131

2. Predicate 510(k) numbers:

See predicate device names above.

3. Comparison with predicate:

Similarities and Differences for Na/K/Cl		
Item	Candidate device k172232	Predicate device k080468
Intended use	For the quantitative determination of the sodium, potassium, and chloride concentration in serum.	Same
Method	Ion Selective Electrode	Same
Specimen types	Serum	Same
Measuring Range	Na: 53 - 200 mmol/L K: 1.8 - 10.1 mmol/L Cl: 50 - 200 mmol/L	Na: 27 - 200 mmol/L K: 0.4 - 20 mmol/L Cl: 27 - 200 mmol/L

Similarities and Differences for Creatinine		
Item	Subject device k172232	Predicate device k941837
Intended use	For the quantitative determination of the creatinine concentration in serum.	Same
Method	Colorimetric – Jaffe reaction.	Same
Specimen types	Serum	Serum, plasma, and urine
Measuring Range	0.2 - 20 mg/dL	0 - 30 mg/dL serum 0 - 200 mg/dL urine

Similarities and Differences for LIASYS 600		
Item	Candidate device k172232	Predicate device k113131
Intended use	A random access, computer controlled, standalone clinical analyzer for clinical chemistry intended for the in-vitro determination of analytes in human serum.	Same
Measurement Modes	Absorbance and ion selective electrodes.	Same
Throughput	Absorbance: 600 tests per hour Ion selective electrodes: Serum 120 tests/hr	Absorbance: 450 tests per hour Ion selective electrodes: Serum 120 tests/hr Urine 60 tests/hr

K. Standard/Guidance Document Referenced:

CLSI EP05-A3 Evaluation of Precision of Quantitative Measurement Procedures; Approved Guideline - Third Edition.

CLSI EP07-A2 Interference Testing in Clinical Chemistry; Approved Guideline - Second Edition.

CLSI EP17-A2 Evaluation of Detection Capability for Clinical Laboratory Measurement Procedures; Approved Guideline - Second Edition.

L. Test Principle:

The sodium, potassium, and chloride assays are based on ion selective electrode technologies that are specific for each ion of interest in the sample. An electrical potential is developed according to the Nernst Equation for a specific ion. When compared to the internal solution, this electrical potential is translated into voltage and then into the ion concentration of the sample.

The creatinine assay is a photometric assay based on Jaffe reaction, in which creatinine reacts with picric acid under alkaline conditions to form a colored complex with absorbance at 510 nm.

M. Performance Characteristics:

1. Analytical performance:

a. *Precision/Reproducibility:*

The precision performance for sodium, potassium, chloride, and creatinine was established by a within-laboratory study following the recommendations in CLSI EP05-A3 guideline. In the study, serum based control material samples were tested in duplicate per run with 2 runs per day over 20 days for a total of 80 measurements. The results are summarized below.

Sodium

Mean, mmol/L	Repeatability %CV	Between-Run %CV	Between-Day % CV	Within-laboratory %CV
161	0.6%	0.6%	0.5%	1.0%
141	0.6%	0.6%	0.7%	1.1%
122	0.6%	0.3%	0.7%	1.0%

Potassium

Mean, mmol/L	Repeatability %CV	Between-Run %CV	Between-Day % CV	Within-laboratory %CV
6.13	0.9%	1.3%	1.3%	2.0%
4.48	1.1%	1.1%	1.1%	1.9%
2.57	1.1%	0.9%	2.1%	2.5%

Chloride

Mean, mmol/L	Repeatability %CV	Between-Run %CV	Between-Day % CV	Within-laboratory %CV
121	0.8%	0.2%	0.7%	1.1%
105	0.6%	0.7%	0.2%	0.9%
91.9	0.7%	0.5%	0.9%	1.2%

Creatinine

Mean, mg/dL	Repeatability %CV	Between-Run %CV	Between-Day % CV	Within-laboratory %CV
0.48	5.7%	2.3%	5.8%	8.5%
1.11	1.7%	1.4%	4.0%	4.6%
4.55	1.7%	2.2%	2.2%	3.6%
12.48	0.9%	1.8%	1.0%	2.3%
16.73	0.8%	0.8%	0.9%	1.5%

b. Linearity/assay reportable range:

The linearity performance of the LIASYS 600 for sodium, potassium, chloride, and creatinine was established in a study by testing six samples across the measurement range in replicates of 2. The samples were commercially available standards. The expected values were plotted against the observed values and a linear regression line was fitted with the following regression equations:

Analyte	Slope	Intercept	Correlation coefficient, R
Sodium	0.989	0.8	0.978
Potassium	1.000	0.14	0.999
Chloride	0.994	1.6	0.988
Creatinine	0.990	0.13	0.980

The linearity studies support the following claimed measurement ranges:

Analyte	Analytical Measurement Range	Sample Range Tested
Sodium	53 – 200 mmol/L	26 – 204 mmol/L
Potassium	1.8 – 10.1 mmol/L	0.6 – 10.1 mmol/L
Chloride	50 – 200 mmol/L	26 – 200 mmol/L
Creatinine	0.2 – 20.0 mg/dL	0.1 – 19.7 mg/dL

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

The sodium, potassium, chloride, and creatinine assays on the LIASYS 600 are traceable to commercially available standards whose concentrations were verified against NIST Standard Reference Material (SRM) 919b for sodium, SRM 918c for potassium, SRM 956d for chloride, and SRM 914a for creatinine.

d. Detection limit:

The detection limit of the LIASYS 600 creatinine assay was assessed in a study measuring the limit of quantitation (LoQ) following the recommendation in CLSI EP17-A2 guideline. The low level creatinine samples were measured in 10 replicates per run with 3 runs per day for 3 days. The results support the claimed LoQ for creatinine of 0.19 mg/dL using the sponsor definition of LoQ as the lowest concentration with <20% CV.

The lower limit of the measurement range, supported by linearity studies above in M.1.b defines the detection limit for the LIASYS 600 sodium, potassium, and chloride assays.

e. *Analytical specificity:*

Interference testing on the LIASYS 600 for sodium, potassium, chloride, and creatinine was evaluated follow the recommendations in CLSI EP07-A2 guideline. The study tested for possible interference from bilirubin, lipemia, and hemolysis. Testing was conducted using samples with the following analyte concentrations: sodium = 138 mmol/L, potassium = 4 mmol/L, chloride = 93 mmol/L, creatinine = 1.1 mg/dL. The samples were divided into two aliquots: control sample with no added interferent and test sample with interferent added. The test samples were serially diluted into a series and measured in duplicates to identify the highest concentration without significant bias (i.e., <10% difference between test and control). The results of the study are given below.

Sodium – Substances tested	Highest concentration without significant interference
Hemoglobin	1000 mg/dL
Bilirubin conjugate, ditaurate	10.7 mg/dL
Intralipid	1130 mg/dL

Potassium – Substances tested	Highest concentration without significant interference
Hemoglobin	900 mg/dL
Bilirubin conjugate, ditaurate	17.3 mg/dL
Intralipid	1130 mg/dL

Chloride – Substances tested	Highest concentration without significant interference
Hemoglobin	1000 mg/dL
Bilirubin conjugate, ditaurate	17.3 mg/dL
Intralipid	1130 mg/dL

Creatinine – Substances tested	Highest concentration without significant interference
Hemoglobin	500 mg/dL
Bilirubin conjugate, ditaurate	7.9 mg/dL
Intralipid	538 mg/dL

The following limitations are identified in the product labeling:

Do not test for sodium in icteric samples.

Do not test for creatinine in icteric samples.

f. Assay cut-off:

Not applicable.

2. Comparison studies:

a. Method comparison with predicate device:

The accuracy performance of the LIASYS 600 was evaluated in a method comparison study by comparing sodium, potassium, chloride, and creatinine measurements for agreement to legally marketed comparator methods. For the study, serum specimens were tested in singlicate on the subject device and in duplicate on the comparator methods. To cover the measurement range, no more than 10% of the samples were diluted and/or spiked. The results of the method comparison study are summarized as follows.

Deming regression analysis

Analyte	Slope	Intercept	R	N	Range Tested
Sodium	1.019	-3.2	0.990	110	53 - 197 mmol/L
Potassium	1.056	-0.3	0.998	111	1.80 - 9.70 mmol/L
Chloride	0.956	6.8	0.990	117	50 - 192 mmol/L
Creatinine	1.031	0.08	0.998	109	0.2 to 19.8 mg/dL

b. Matrix comparison:

Not applicable, only human serum samples are indicated.

3. Clinical studies:

a. Clinical Sensitivity:

Not applicable.

b. Clinical specificity:

Not applicable.

c. Other clinical supportive data:

Not applicable.

4. Clinical cut-off:

Not applicable.

5. Expected values/Reference range:

The product labeling identifies the following reference ranges from the literature:

Sodium ¹	136 – 145 mmol/L
Potassium ¹	3.5 – 5.1 mmol/L
Chloride ¹	98 – 107 mmol/L
Creatinine ²	
men	0.72 – 1.18 mg/dL
women	0.55 – 1.02 mg/dL

Sources:

1. *Tietz, textbook of Clinical Chemistry 2nd ed, Philadelphia, W.B. Saunders, (1994).*
2. *Henry RJ (Ed). Clin. Chem. Principles and Techniques (2nd Ed). Harper and Row. 1974, 548-551.*

N. Instrument Name:

LIASYS 600

O. System Descriptions:

1. Modes of Operation:

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

Yes X or No

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

Yes or No X

2. Software:

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

Yes X or No

3. Specimen Identification:

Barcode option for specimen identification.

4. Specimen Sampling and Handling:

Sample specimens are loaded onto the instrument's two independent carousels which can host a total of 100 samples.

5. Calibration:

The product labeling recommends for calibration of sodium, potassium, and chloride the use of an appropriate ISE calibrator, and for the creatinine assay the use of AMS Chemistry Calibrator.

6. Quality Control:

The product labeling recommends for quality control the use of two levels of external quality control materials.

P. Other Supportive Instrument Performance Characteristics Data Not Covered In The “Performance Characteristics” Section above:

Not applicable.

Q. Proposed Labeling:

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

R. Conclusion:

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