

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

A. 510(k) Number:

k153644

B. Purpose for Submission:

New device

C. Measurand:

Glucose

D. Type of Test:

Quantitative, Enzymatic (Hexokinase) end point, UV

E. Applicant:

ELITechGroup, Inc.

F. Proprietary and Established Names:

ELITech Clinical Systems GLUCOSE HK SL

ELITech Clinical Systems ELICAL 2

ELITech Clinical Systems ELITROL I and ELITROL II

G. Regulatory Information:

Product Code	Classification	Regulation Section	Panel
CFR	II	862.1345, Glucose Test System	75-Chemistry
JIX	II	862.1150, Calibrators	75- Chemistry
JJY	I, reserved	826.1660, Multi-analyte Controls	75- Chemistry

H. Intended Use:

1. Intended use(s):

See Indications for Use below

2. Indication(s) for use:

ELITech Clinical Systems GLUCOSE HK SL is intended for the quantitative in vitro diagnostic determination of glucose in human serum, plasma and urine on ELITech Clinical Systems Selectra Pro Series Analyzers. Glucose measurements are used in the diagnosis and treatment of carbohydrate metabolism disorders including diabetes mellitus and idiopathic hypoglycemia, and of pancreatic diseases.

ELITech Clinical Systems ELICAL 2 is a multi-parametric calibrator for in vitro diagnostic use in the calibration of quantitative ELITech Clinical Systems methods on ELITech Clinical Systems Analyzers.

ELITech Clinical Systems ELITROL I and ELITROL II are multi-parametric control sera for in vitro diagnostic use in quality control of quantitative ELITech Clinical Systems methods on ELITech Clinical Systems Analyzers.

3. Special conditions for use statement(s):

This device is intended for prescription use and in vitro diagnostic use only. It is not intended for use in Point of Care settings.

4. Special instrument requirements:

ELITech Clinical Systems Selectra ProM Analyzer

I. Device Description:

ELITech Clinical Systems GLUCOSE HK SL is available as a kit only. It consists of 8x20ml of R1 and 8x5ml of R2, sufficient for 8x57 tests:

Reagent 1 (R1): Pipes buffer, pH 7.60 80 mmol/L, NAD 4.1 mmol/L, ATP 2.2 mmol/L, Sodium azide < 0.1 %.

Reagent 2 (R2): Hexokinase \geq 8500 U/L, G-6-PDH \geq 8500 U/L, Magnesium salt 20 mmol/L, Sodium azide < 0.1 % mmol/L.

ELITech Clinical Systems ELICAL2 is a lyophilized calibrator based on human serum containing constituents to ensure optimal calibration. ELICAL 2 must be used to calibrate the ELITech Clinical Systems GLUCOSE HK SL assay. ELICAL 2 is sold separately.

ELITech Clinical Systems ELITROL I and ELITROL II are two-level quality control products consisting of a lyophilized human serum containing constituents at desired levels. ELITROL I and ELITROL II should be used with the ELITech Clinical Systems GLUCOSE HK SL assay. ELITROL I and ELITROL II are sold separately.

ELICAL 2, ELITROL I and ELITROL II are prepared exclusively from the blood of donors

tested individually and found to be negative for HbsAg and to antibodies to HCV and HIV according to FDA-approved methods.

J. Substantial Equivalence Information:

1. Predicate device name(s):

Roche Diagnostics Cobas C111 Glucose HK
 Roche Calibrator for Automated Systems (C.f.a.s.)
 Roche Diagnostics Precinorm U and Precipath U

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

k951595
 k033501
 k041227

3. Comparison with predicate:

Glucose assay:

Item	Candidate Device	Predicate Device
Characteristics	ELITech Clinical Systems GLUCOSE HK SL (k153644)	ROCHE DIAGNOSTICS GLUCOSE HK (k951595)
Similarities		
Intended Use	For the quantitative determination of glucose in human serum, plasma and urine. It is not intended for use in Point of Care settings.	Same
Test Principle	Enzymatic (hexokinase).	Same
Reagent Format	Liquid form, ready to use	Same
Same Type	Serum, Plasma, Urine	Same
Differences		
Assay Range	Serum, Plasma: 20-720 mg/dL Urine: 10-720 mg/dL	Serum, Plasma, Urine: 1.98-720 mg/dL
Recommended Controls (not included in the kit)	ELITech Clinical Systems ELITROL I (Normal) ELITech Clinical Systems ELITROL II (Pathologic control)	Precinorm U or Precinorm U plus and Precipath U or Precipath U plus
Recommended Calibrators (not included in the kit)	ELITech Clinical Systems ELICAL 2	Calibrator C.f.a.s

ELITech Clinical Systems ELITROL I and ELITROL II (Quality controls):

Item	Candidate Device	Predicate Device
Characteristics	ELITech Clinical Systems ELITROL I / ELITROL II (k153644)	Roche Diagnostics Precinorm U / Precipath U (k041227)
Similarities		
Intended Use	Multi-parametric control sera for in vitro diagnostic use in quality control of respective quantitative method/analyzer systems	Same
Levels	2	Same
Format	Lyophilized human sera with constituents added as required to obtain defined component levels	Same
Stability	Lyophilized: To store at 2-8°C and protected from light until the expiry date After reconstitution, the stabilities are : - 12 hours between 15-25 °C. - 5 days between 2-8 °C. - 4 weeks between -25 and -15 °C (when frozen once)	Same
Differences		
Intended Analyzers	ELITech Clinical Systems Analyzers	Roche/Hitachi MODULAR, cobas c and COBAS INTEGRA analyzers

ELITech Clinical Systems ELICAL 2 (Calibrator):

Item	Candidate Device	Predicate Device
Characteristics	ELITech Clinical Systems ELICAL 2 (k153644)	Roche Calibrator for Automated Systems (C.f.a.s.) (k033501)
Similarities		
Intended Use	Multi-parametric calibrator for in vitro diagnostic use	Same
Levels	Single level	Same
Format	Lyophilized calibrator based on human serum with constituents added as requires to obtain desired component levels	Same
Stability	Lyophilized: To store at 2-8°C and protected from light until the expiry date After reconstitution, the stabilities are : - 8 hours between 15-25 °C. - 2 days between 2-8 °C. - 4 weeks between -25 and - 15 °C (when frozen once)	Same
Differences		
Intended Analyzers	ELITech Clinical Systems Analyzers	Roche/Hitachi MODULAR, cobas c and COBAS INTEGRA analyzers

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

CLSI - EP05-A2, Evaluation of Precision Performance of Quantitative Measurement Methods; Approved Guideline-Second Edition.

CLSI - EP06-A, Evaluation of the Linearity of Quantitative Measurement Procedures: A Statistical Approach; Approved Guideline.

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

CLSI EP9-A2, Method Comparison and Bias Estimation Using Patient Samples; Approved Guideline-Second Edition.

CLSI - EP17-A, Protocols for the Determination of Limits of Detection and Limits of Quantification; Approved Guideline.

L. Test Principle:

The reaction of glucose with ATP produces Glucose-6-phosphate which in presence of NAD^+ will produce D-Gluconate-6-phosphate + $\text{NADH} + \text{H}^+$

The increase of absorbance is directly proportional to the glucose concentration.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:

ELITech Clinical Systems Selectra ProM Analyzers were used to conduct the performance studies below.

a. *Precision/Reproducibility:*

The precision of the device was determined in accordance to CLSI EP05-A2 protocol.

Within-run and total precision results were obtained by performing two runs per day, two measurements per run, for 4 levels of serum samples and 3 levels of urine samples on two Selectra ProM analyzers during twenty operating days. The results are presented in the table below:

Serum samples precision*:

Level	N	Mean (mg/dL)	Precision (CV %)	
			Within Run	Total
1	80	45.5	1.1	2.0
2	80	119.5	0.9	1.7
3	80	251.5	0.9	2.0
4	80	522.5	0.4	1.8

*Level 1 is a natural human serum pool, level 2 and 4 are spiked human serum pool and level 3 is a control sera (ELITROL II).

Urine samples precision*:

Level	N	Mean (mg/dL)	Precision (CV %)	
			Within Run	Total
1	80	18.0	0.9	2.0
2	80	204.4	0.7	1.7
3	80	497.4	0.6	1.7

* Level 1 is a natural human urine pool, level 2 and level 3 are spiked human urine pool.

b. *Linearity/assay reportable range:*

The linearity of the assay for serum and urine matrix was evaluated respectively by mixing a spiked patient serum and urine pool with high glucose and a diluted patient serum and urine pool with low glucose (diluted with Albumin 6 g/dL / NaCl 0.9%) to obtain 11 equidistant concentrations (10% increase each level). The glucose concentration of each level was measured in triplicates using one lot of ELITech Clinical Systems GLUCOSE HK SL reagent on one Selectra ProM analyzer. The mean of the triplicates was used in the regression analysis. Results are summarized below.

Serum:

High sample: 726.6 mg/dL; Low sample: 20.0 mg/dL
 $y = 1.025x - 1.9618$, $R^2 = 0.9999$
Claimed measuring range: 20-720 mg/dL

Urine:

High sample: 726.6 mg/dL; Low sample: 10.1 mg/dL
 $y = 1.0155x - 1.596$, $R^2 = 0.9998$
Claimed measuring range: 10-720 mg/dL

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

Traceability:

ELITech Clinical Systems GLUCOSE HK SL method is traceable to NIST SRM 965b reference material.

Stability:

ELITROL I and II serum control material is purchased from a commercial vendor (previously cleared under k041227). The following is claimed for stability: Before reconstitution, the shelf-life of the ELITROL I and ELITROL II is 24 months at 2-8°C. After reconstitution the stability is 12 hours when stored at 15-25°C, 5 days when stored at 2-8°C or 4 weeks (when frozen once) at -25° and -15° C.

ELICAL 2 calibrator material is purchased from a commercial vendor (previously cleared under k033501). The following is claimed for stability: Before reconstitution, the shelf-life of ELICAL 2 is stable 24 months at 2-8°C. After reconstitution the stability is 8 hours when stored at 15-25°C, 2 days at 2-8°C or 4 weeks (when frozen once) at -25° and -15°C. The labeling states that the ELICAL 2 should be stored tightly capped and protected from light when not in use.

Value Assignment:

Each lot of ELITROL I and II are value assigned using the median of the observed values (at least 48 measurements in total: 2 analyzers x 2 reagent lots x 3 vials per test lot x 4 measurements per vial). The lot release criteria is that the assigned value should be within $\pm 15\%$ of the supplier's value, and the CV should be $\leq 2.4\%$ for ELITROL I, and $\leq 1.8\%$ for ELITROL II. The control ranges are lot specific, an example of one lot of control ranges is provided below:

ELITROL I: mean = 95.1 mg/dL, control range = 80.8 to 109.4 mg/dL

ELITROL II: mean = 252.8 mg/dL, control range = 214.9 to 290.7 mg/dL

For each lot of ELICAL 2, the calibrator concentration on the supplier's certificate of analysis is verified by testing the released lot of ELITRO I, ELITROL II and ELICAL 2 tested in triplicate on one instrument using two reagent lots. The release criteria are that the mean analyte values of ELITRO I, ELITROL II and ELICAL 2 are within $\pm 7.5\%$ of the target value. The calibrator value is lot specific, an example of one lot of calibrator is provided below:

ELICAL 2: Target value =196 mg/dL

d. Detection limit:

Limit of Blank (LoB), Limit of Detection (LoD) and Limit of Quantitation (LoQ) was determined according to the CLSI EP-17A guideline on Selectra ProM Analyzers.

Limit of Blank (LoB) was determined using 60 measurements of blank sample (Solution of Albumin 6 g/dL /NaCl 0.9%). Limit of Detection (LoD) was determined using 15 measurements of 4 samples with a low concentration of glucose (approximately $4 \times \text{LoB} \approx 0.4 \text{ mg/dL}$). For the determination of the Limit of Quantification (LoQ), four (4) diluted sample pools are prepared from 4 different patient sample pools of known concentrations (measured by the test method) in order to obtain a concentration close to the expected LoQ target of 5 mg/dL. The sponsor validated the LoQ claim of 5 mg/dL; the %CV of serum samples at the target LoQ of 5.0 mg/dL is $<3.5\%$, and the %CV of urine samples at the target LoQ of 5.0 mg/dL is $<3\%$. Results are summarized in the table below.

Measurand	LoB	LoD	LoQ
Glucose (Serum) (mg/dL)	0.1	0.3	5.0
Glucose (Urine) (mg/dL)	0.1	0.2	5.0

The claimed measuring range of the candidate device is 20 to 720 mg/dL for serum sample, and is 10 to 720 mg/dL for urine sample.

e. *Analytical specificity:*

Various concentrations of potential interferents were spiked into two sample pools with low and high glucose levels in serum and urine, respectively, to support the specificity claim of each matrix. Testing was performed on Selectra ProM Analyzers and the mean of triplicate measurements of each sample was used to calculate the difference between the spiked and the control samples. The sponsor states that interference is considered to be non-significant if the bias between the tested and control samples are within $\pm 10\%$. For each interferent, 6-9 levels were tested and the highest concentration tested that shows non-significant interference are summarized below:

Serum (Low sample pool at 50 mg/dL, high sample pool at 120 mg/dL of Glucose)

Interferents	Test range up to	Highest level tested with no interference
Triglycerides	3000 mg/dL	622 mg/dL
Unconjugated bilirubin	30 mg/dL	30 mg/dL
Conjugated bilirubin	29.5 mg/dL	29.5 mg/dL
Hemoglobin	500 mg/dL	500 mg/dL
Uric Acid	20 mg/dL	20 mg/dL
L-Dopa	30 mg/dL	30 mg/dL
Ascorbic acid	20 mg/dL	20 mg/dL
Methyl dopa	2.0 mg/dL	2.0 mg/dL
Tolazamide	50 mg/dL	50 mg/dL
Acetaminophen	30 mg/dL	30 mg/dL

Urine (Low sample pool at 18.0 mg/dL, high sample pool at 200 mg/dL of Glucose)

Interferents	Test range up to	Highest level tested with no interference
Conjugated bilirubin	29.5 mg/dL	29.5 mg/dL
Hemoglobin	500 mg/dL	500 mg/dL
Uric Acid	100 mg/dL	100 mg/dL
Urea	6000 mg/dL	6000 mg/dL
pH	pH from 2.5 to 12.0	pH 12.0
Specific Gravity	1.000 to 1.030	1.030

Sponsor has the following conclusions based on their triglycerides interference and included this information in the labeling:

“Triglycerides at a concentration of ~1300 mg/dL decreased glucose result in serum at 50 mg/dL by 32% and at 120 mg/dL by 19%.”

Sponsor also has the following limitations in the labeling:

1. Do not use hemolyzed samples.
2. Do not use lipemic samples.
3. Urine collected over 24 hours in a dark bottle, adding 5mL of glacial acetic acid before sample collection.
4. In addition, the sponsor also states the following in their labeling:

Other compounds may interfere. Users should refer to the following literature references:

-Young, D. S., Effects of preanalytical variables on clinical laboratory tests, 2nd Ed., AACC Press, (1997).

-Young, D. S., Effects of drugs on clinical laboratory tests, 4th Ed., AACC Press, (1995).

-Berth, M. & Delanghe, J. Protein precipitation as a possible important pitfall in the clinical chemistry analysis of blood samples containing monoclonal immunoglobulins: 2 case reports and a review of literature, Acta Clin Belg., (2004), 59, 263.

f. Assay cut-off:

Not Applicable

2. Comparison studies:

a. Method comparison with predicate device:

Method comparison was performed between the predicate method and ELITech Clinical Systems GLUCOSE HK SL reagent on a Selectra ProM analyzer. The results for serum and urines samples are summarized below. A single test result using the proposed candidate method, and the mean of triplicate measurements using the comparative method, were used in the regression analysis. The altered samples used for each matrix are no more than 10%. Results are summarized in the table below.

Matrix	N	Linear regression	Candidate Device Sample range (mg/dL)
Serum	100	$y=1.008x + 0.430$ $R^2=1.000$	20.5 to 707.5
Urine (24-hr., collected with glacial acetic acid as a preservative)	40	$y= 0.996x - 0.4$ $R^2 = 1.000$	10.1 to 703.9

b. Matrix comparison:

The sponsor performed a matrix comparison study by comparing 40 lithium heparin samples ranging from 25.2 to 704.5 mg/dL and 40 sodium fluoride/ oxalate samples ranging from 21.0 to 719.7 mg/dL to serum samples on the Selectra ProM analyzer. Regression analysis of the results yielded the following:

Lithium heparin vs Serum: $y=1.001x - 0.7$ mg/dL, $r= 1.000$

Sodium fluoride/ oxalate vs Serum: $y= 1.016x - 0.9$ mg/dL, $r= 0.999$

The matrix comparison study results support the use of lithium heparin and sodium fluoride/ oxalate samples in addition to serum samples for glucose measurement using the ELITech Clinical Systems GLUCOSE HK SL 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:

Serum/ Plasma*:

74 - 106 mg/dL (4.1 – 5.9 mmol/L)

Urine (24 hours collection)*:

<0.5 g/day (1-15 mg/dL)

<2.78 mmol/day (0.1 - 0.8 mmol/L)

*These reference values are from:

Wu, A. H. B., Clinical guide to laboratory tests, 4th Ed., (W.B. Saunders eds. Philadelphia USA), (2006), 444

N. Proposed Labeling:

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

O. Conclusion:

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