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

**A. 510(k) Number:**

k091413

**B. Purpose for Submission:**

New devices

**C. Measurand:**

Cholesterol, HDL Cholesterol, and Triglyceride

**D. Type of Test:**

Quantitative, enzymatic photometric

**E. Applicant:**

Alfa Wasserman Diagnostic Technologies, LLC

**F. Proprietary and Established Names:**

S-Test Cholesterol (CHO)

S-Test High Density Lipoprotein Cholesterol (HDL)

S-Test Triglycerides (TG)

**G. Regulatory Information:**

1. Regulation section:

   21 CFR 862.1175 - Cholesterol (total) test system

   21 CFR 862.1475 - Lipoprotein test system

   21 CFR 862.1705 Triglyceride test system

2. Classification:

   Class I, meet limitations of exemptions per 21 CFR 862.9 (c)(4) and (c)(9)

3. Product code:

   CHH

   LBS

   CDT

4. Panel:

   75 (clinical chemistry)

**H. Intended Use:**

1. Intended use(s):

   Refer to indications for use below.

2. Indication(s) for use:

   Cholesterol

   The S-Test Cholesterol Reagent is intended for the quantitative determination of cholesterol concentration in serum or heparin plasma using the S40 Clinical Analyzer. Cholesterol measurements are used in the diagnosis and treatment of disorders involving excess cholesterol in the blood, lipid and lipoprotein metabolism disorders. This test is intended for use in clinical laboratories or physician office laboratories. For *in vitro* diagnostic use only.

   HDL Cholesterol

   The S-Test High Density Lipoprotein Reagent is intended for the quantitative determination of HDL concentration in serum or heparin plasma using the S40 Clinical Analyzer. Lipoprotein measurements are used in the diagnosis and treatment of lipid disorders (such as diabetes mellitus), atherosclerosis, and various liver and renal diseases. This test is intended for use in clinical laboratories or physician office laboratories. For *in vitro* diagnostic use only.

   Triglyceride
   The S-Test Triglycerides Reagent is intended for the quantitative determination of triglyceride concentration in serum or heparin plasma using the S40

Clinical Analyzer. Triglyceride measurements are used in the diagnosis and treatment of patients with diabetes mellitus, nephrosis, liver obstruction, other diseases involving lipid metabolism, or various endocrine disorders. This test is intended for use in clinical laboratories or physician office laboratories. For *in vitro* diagnostic use only.

3. Special conditions for use statement(s):

   For prescription use only

4. Special instrument requirements:

   Alfa Wasserman Diagnostic Technologies S40 Clinical Analyzer

## I. Device Description:

All three reagents are provided in a ready-to-use cartridge with a barcode to automatically identify the reagent to the S40 clinical analyzer. Each cartridge has a separate reservoir for reagent 1 and reagent 2, a reaction cell, and a photometric cuvette.

The S-Test Cholesterol (CHO) Reagent Cartridge has the following components:

| **Component** | **Quantity** |
|---|---|
| CHO Reagent (1) | |
| 4-aminoantipyrine | 1.6 mmol/L |
| Cholesterol oxidase | > 0.2 U/mL |
| Peroxidase (Horseradish) | > 1.6 U/mL |
| CHO Reagent (2) | |
| Cholesterol oxidase | 2 U/mL |
| N-ethyl-N-sulfobutyl-m-toluidine disodium salt | 1.5 mmol/L |

The S-Test High Density Lipoprotein (HDL) Reagent Cartridge has the following components:

| **Component** | **Quantity** |
|---|---|
| HDL Reagent (1) | |
| N, N-bis (4-sulfobutyl)-m-toluidine disodium salt (DSBmT) | 0.5 mmol/L |
| Cholesterol oxidase | 1.0 U/mL |
| Bis (2-hydroxyethyl) iminotris (hydroxymethyl) methane (Bis-Tris) (pH 6.0) | 50 mmol/L |
| Peroxidase (Horseradish) | < 1.3 ppg U/mL |

HDL Reagent (2)

| | |
|---|---|
| 4-aminoantipyrine | 1.0 mmol/L |
| Surface-active agent | < 2% |
| Bis (2-hydroxyethyl) iminotris (hydroxymethyl) methane (Bis-Tris) (pH 6.0) | 50 mmol/L |
| Cholesterol oxidase | ≥ 1.0 U/mL |

The S-Test Triglycerides (TG) Reagent Cartridge has the following components:

| **Component** | **Quantity** |
|---|---|
| TG Reagent (1) | |
| Glycerol kinase | 1.5 U/mL |
| Glycerol-3-phosphate oxidase | 2 U/mL |
| N-ethyl-N-sulfobutyl-m-toluidine disodium salt | 1.5 mmol/L |
| Piperazine-N-N'-bis (2-ethanesulfonic acid (PIPES) buffer (pH 7.0) | 100 mmol/L |
| TG Reagent (2) | |
| 4-aminoantipyrine | 2.5 mmol/L |
| Lipoprotein lipase | > 1 U/mL |
| Peroxidase (Horseradish) | > 5 U/mL |
| Piperazine-N-N'-bis (2-ethanesulfonic acid (PIPES) buffer (pH 6.5) | 50 mmol/L |

## J. Substantial Equivalence Information:

1. Predicate device name(s):

   Alfa Wassermann Ace CHOLESTEROL Reagent

   Alfa Wassermann Ace HDL-C (HDLNEW) Reagent

   Alfa Wassermann Ace TRIGLYCERIDES Reagent

2. Predicate 510(k) number:

   k931786

3. Comparison with predicate:

   Cholesterol

| **Similarities** | | |
|---|---|---|
| Item | Device | Predicate |
| Intended Use | Same | Intended for the quantitative determination of total cholesterol. |

| Similarities | | |
|---|---|---|
| Item | Device | Predicate |
| Cholesterol Reference Method Laboratory Network (CRMLN) certification | Not certified | Not certified |
| Principle | Same | Enzymatic (cholesterol esterase/cholesterol oxidase) |
| Intended Sites | Same | Clinical laboratories or physician office labs |

| Differences | | |
|---|---|---|
| Item | Device | Predicate |
| Instrument Platform(s) | S40 Clinical Analyzer | ACE and NExCT Clinical Chemistry Systems |
| Calibration | Each lot is calibrated by the manufacturer prior to shipment using material traceable to NIST Standard Reference Material 911 | Calibrated by referencing the change in absorbance of the unknown samples to the change in absorbance of the standard; the use of GEMCAL Reference Serum is recommended |
| Matrix | Serum or Heparin Plasma | Serum |
| Sample Volume | 10 µL | 3 µL |
| Detection Limit | 7 mg/dL | 2 mg/dL |
| Linearity Range | 7 – 370 mg/dL | 2 – 600 mg/dL |
| Detection Wavelength | 600/800 nm | 505/647 nm |

HDL Cholesterol

| **Similarities** | | |
|---|---|---|
| Item | Device | Predicate |
| Intended Use | Same | Intended for the quantitative determination of HDL cholesterol. |
| Traceability | Each lot is calibrated by the manufacturer prior to shipment using material traceable to HECTEF (Standard Reference Center Foundation, Ltd.) JCCRM223. The 2-D barcode printed on each cartridge provides the analyzer with lot-specific calibration data. | Calibrated by referencing the change in absorbance of the unknown samples to the change in absorbance of the standard; the use of GEMCAL Reference Serum is recommended. |
| Cholesterol Reference Method Laboratory Network (CRMLN) certification | Not certified | Not certified |
| Principle | Same | Detergent solubilization of HDL to selectively measure HDL cholesterol using an enzymatic method |
| Intended Sites | Same | Clinical laboratories or physician office labs |

| **Differences** | | |
|---|---|---|
| Item | Device | Predicate |
| Instrument Platform(s) | S40 Clinical Analyzer | ACE and NExCT Clinical Chemistry Systems |
| Calibration | Each lot is calibrated by the manufacturer prior to shipment using material traceable to Reference Material Institute for Clinical Chemistry Standards JCCRM223 | Calibrated by referencing the change in absorbance of the unknown samples to the change in absorbance of the standard; the use of GEMCAL Reference Serum is recommended |

| Differences | | |
|---|---|---|
| Item | Device | Predicate |
| Matrix | Serum or Heparin Plasma | Serum |
| Sample Volume | 5 µL | 3 µL |
| Detection Limit | 6 mg/dL | 4 mg/dL |
| Linearity Range | 14 – 125 mg/dL | 4 – 125 mg/dL |
| Detection Wavelength | 600/700 nm | 592/692 nm |

Triglyceride

| Similarities | | |
|---|---|---|
| Item | Device | Predicate |
| Intended Use | Same | Intended for the quantitative determination of triglyceride. |
| Principle | Same | Coupled enzymatic reaction that uses lipase, glycerol kinase, glycerol-3-phosphate oxidase and peroxidase enzymes to form a colored pigment |
| Intended Sites | Same | Clinical laboratories or physician office labs |

| Differences | | |
|---|---|---|
| Item | Device | Predicate |
| Instrument Platform(s) | S40 Clinical Analyzer | ACE, ACE Alera, and NExCT Clinical Chemistry Systems |
| Calibration | Each lot is calibrated by the manufacturer prior to shipment using material traceable to Reference Material Institute for Clinical Chemistry Standards JCCRM223 | Calibrated by referencing the change in absorbance of the unknown samples to the change in absorbance of the standard; the use of GEMCAL Reference Serum is recommended |
| Matrix | Serum or Heparin Plasma | Serum |
| Sample Volume | 5 µL | 3 µL |
| Detection Limit | 12 mg/dL | 6 mg/dL |
| Linearity Range | 15 – 746 mg/dL | 6 – 1000 mg/dL |
| Detection Wavelength | 600/800 nm | 505/692 nm |

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

CLSI EP6-A: Evaluation of the Linearity of Quantitative Measurement Procedures: A Statistical Approach; Approved Guideline

CLSI EP7-A2: Interference Testing in Clinical Chemistry; Approved Guideline - Second Edition

CLSI EP5-A2: Evaluation of Precision Performance of Quantitative Measurement Methods; Approved Guideline - Second Edition

CLSI EP10-A3: Preliminary Evaluation of Quantitative Clinical Laboratory Measurement Procedures; Approved Guideline - Third Edition

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

CLSI EP17-A: Protocols for Determination of Limits of Detection and Limits of Quantitation; Approved Guideline

**L. Test Principle:**

Cholesterol

The cholesterol in the sample is classified into cholesterol esters and free cholesterol. The cholesterol esters become free cholesterol through the action of cholesterol esterase (CE).

The free cholesterol is oxidized by cholesterol oxidase (COD) to produce hydrogen peroxide, esters and free cholesterol. The cholesterol esters become free cholesterol through the action of cholesterol esterase (CE).

The hydrogen peroxide oxidizes and condenses 4-aminoaminoantipyrine and N-ethyl-N-sulfobutyl-m-toluidine (ESBmT) under the influence of peroxidase (POD) to produce a reddish-purple pigment.

Total cholesterol concentration is determined by measuring the absorbance of this reddish-purple pigment. The difference in absorbance, monitored bichromatically at 600 nm/800 nm is directly proportional to the cholesterol concentration in the sample.

HDL Cholesterol

By using a special surface-active agent that preferentially solubilizes HDL and not other lipoproteins (LDL, VLDL, and chylomicrons), the HDL cholesterol

is measured via a quickly initiated enzymatic reaction. Therefore, only HDL cholesterol is specifically measured.

The hydrogen peroxide oxidizes and condenses 4-aminoaminoantipyrine and N,N'-bis(4-sulfobutyl)-m-toluidine disodium salt (DSBmT) in the presence of peroxidase (POD) to produce a reddish-purple pigment.

HDL cholesterol concentration is determined by measuring the absorbance of this reddish-purple pigment. The difference in absorbance, monitored bichromatically at 600 nm/700 nm is directly proportional to the HDL concentration in the sample.

Triglyceride

Free glycerol in the sample is converted to glycerol-3-phosphoric acid through the action of glycerol kinase (GK) and the adenosine triphosphate (ATP) substrate. Glycerol-3-phosphoric acid is converted to hydrogen peroxide via the action of glycerol-3-phosphate oxidase (GPO); peroxide is then decomposed into water and oxygen via the action of catalase.

The neutral fat in the sample is quickly hydrolyzed into glycerol and fatty acid by the lipoprotein lipase (LPL) contained in the second reagent.

The glycerol product is converted to glycerol-3-phosphoric acid via the action of GK and the ATP substrate which in turn produces hydrogen peroxide via the action of GPO. The hydrogen peroxide oxidizes/condenses 4-aminoantipyrine and N-ethyl-N-sulfobutyl-m-toluidine (ESBmT), via the action of peroxidase (POD) to produce a reddish purple pigment. The original neutral fat concentration (triglyceride) is determined by measuring the absorbance of the reddish purple pigment produced.

The difference in absorbance between the final reading and the blank, monitored bichromatically at 600 nm/800 nm, is directly proportional to the triglyceride concentration in the sample.

**M. Performance Characteristics (if/when applicable):**

1. Analytical performance:

   *a. Precision/Reproducibility:*

   Cholesterol

   Precision studies were conducted in house on serum samples at three concentrations over 22 days. Results were as follows:

| Sample 1 (92 mg/dL) | Within Run | Between Run | Between Day | Total |
|---|---|---|---|---|
| Standard Deviation (mg/dL) | 1.1 | 1.6 | 1.2 | 2.3 |
| Coefficient of Variation (%) | 1.2 | 1.8 | 1.3 | 2.5 |

| Sample 2 (171 mg/dL) | Within Run | Between Run | Between Day | Total |
|---|---|---|---|---|
| Standard Deviation (mg/dL) | 1.6 | 2.8 | 2.1 | 3.8 |
| Coefficient of Variation (%) | 0.9 | 1.6 | 1.2 | 2.2 |

| Sample 3 (263 mg/dL) | Within Run | Between Run | Between Day | Total |
|---|---|---|---|---|
| Standard Deviation (mg/dL) | 4.3 | 3.0 | 4.2 | 6.7 |
| Coefficient of Variation (%) | 1.6 | 1.2 | 1.6 | 2.6 |

Precision studies were also conducted in three Physician Office Laboratory (POL) sites on serum samples at three concentrations over five days. Results were as follows:

| | | | SD (mg/dL) or % CV | |
|---|---|---|---|---|
| Lab | Sample | Mean | Within-Run | Total |
| POL 1 | 1 | 107 | SD 1.0 | SD 1.0 |
| | | | 0.9% | 0.9% |
| POL 2 | 1 | 107 | SD 0.7 | SD 0.7 |
| | | | 0.7% | 0.7% |
| POL 3 | 1 | 106 | SD 0.9 | SD 1.1 |
| | | | 0.8% | 1.0% |
| POL 1 | 2 | 184 | SD 1.1 | SD 1.4 |
| | | | 0.6% | 0.8% |
| POL 2 | 2 | 185 | SD 1.8 | SD 1.8 |
| | | | 0.9% | 0.9% |
| POL 3 | 2 | 182 | SD 1.1 | SD 1.3 |
| | | | 0.6% | 0.7% |
| POL 1 | 3 | 287 | SD 2.2 | SD 2.9 |
| | | | 0.8% | 1.0% |
| POL 2 | 3 | 292 | SD 0.9 | SD 2.3 |
| | | | 0.3% | 0.8% |
| POL 3 | 3 | 288 | SD 1.4 | SD 2.0 |
| | | | 0.5% | 0.7% |

HDL Cholesterol

Precision studies were conducted in house on serum samples at three concentrations over 22 days. Results were as follows:

| Sample 1 (24 mg/dL) | Within Run | Between Run | Between Day | Total |
|---|---|---|---|---|
| Standard Deviation (mg/dL) | 0.7 | 1.4 | 0.4 | 1.6 |
| Coefficient of Variation (%) | 2.8 | 5.6 | 1.5 | 6.5 |

| Sample 2 (75 mg/dL) | Within Run | Between Run | Between Day | Total |
|---|---|---|---|---|
| Standard Deviation (mg/dL) | 1.8 | 4.1 | 0.0 | 4.5 |
| Coefficient of Variation (%) | 2.5 | 5.4 | 0.0 | 6.0 |

| Sample 3 (94 mg/dL) | Within Run | Between Run | Between Day | Total |
|---|---|---|---|---|
| Standard Deviation (mg/dL) | 1.9 | 5.4 | 0.0 | 5.7 |
| Coefficient of Variation (%) | 2.0 | 5.7 | 0.0 | 6.1 |

Precision studies were also conducted in three Physician Office Laboratory (POL) sites on serum samples at three concentrations over five days. Results were as follows:

| | | | SD (mg/dL) or % CV | |
|---|---|---|---|---|
| Lab | Sample | Mean | Within-Run | Total |
| POL 1 | 1 | 22 | SD 0.3 | SD 0.3 |
| | | | 1.2% | 1.2% |
| POL 2 | 1 | 22 | SD 0.6 | SD 0.6 |
| | | | 2.7% | 2.7% |
| POL 3 | 1 | 22 | SD 0.5 | SD 0.6 |
| | | | 2.3% | 2.7% |

| | | | SD (mg/dL) or % CV | |
|---|---|---|---|---|
| Lab | Sample | Mean | Within-Run | |
| POL 1 | 2 | 58 | SD 0.9 | SD 1.0 |
| | | | 1.6% | 1.8% |
| POL 2 | 2 | 57 | SD 0.8 | SD 0.8 |
| | | | 1.4% | 1.4% |
| POL 3 | 2 | 58 | SD 1.2 | SD 1.2 |
| | | | 2.1% | 2.1% |
| POL 1 | 3 | 111 | SD 2.4 | SD 2.8 |
| | | | 2.2% | 2.6% |
| POL 2 | 3 | 110 | SD 1.5 | SD 1.9 |
| | | | 1.4% | 1.7% |
| POL 3 | 3 | 113 | SD 2.5 | SD 2.5 |
| | | | 2.3% | 2.3% |

Triglyceride

Precision studies were conducted in house on serum samples at three concentrations over 22 days. Results were as follows:

| Sample 1 (97 mg/dL) | Within Run | Between Run | Between Day | Total |
|---|---|---|---|---|
| Standard Deviation (mg/dL) | 4.0 | 0.9 | 0.5 | 4.2 |
| Coefficient of Variation (%) | 4.1 | 1.0 | 0.5 | 4.3 |

| Sample 2 (130 mg/dL) | Within Run | Between Run | Between Day | Total |
|---|---|---|---|---|
| Standard Deviation (mg/dL) | 4.8 | 1.2 | 2.5 | 5.5 |
| Coefficient of Variation (%) | 3.7 | 0.9 | 1.9 | 4.3 |

| Sample 3 (206 mg/dL) | Within Run | Between Run | Between Day | Total |
|---|---|---|---|---|
| Standard Deviation (mg/dL) | 6.8 | 1.8 | 3.3 | 7.7 |
| Coefficient of Variation (%) | 3.3 | 0.9 | 1.6 | 3.8 |

An additional precision study was conducted in-house using a sample with an elevated triglyceride concentration. A total of 50 replicates were analyzed over 5 days on each of three analyzers Results combining data from all three analyzers were as follows:

| Sample 4 675 mg/dL) | Within Run | Between Run | Between Day | Total |
|---|---|---|---|---|
| Standard Deviation, (mg/dL) | 7.0 | 7.3 | 0.0 | 10.1 |
| Coefficient of Variation (%) | 1.0 | 1.1 | 0.0 | 1.5 |

Precision studies were also conducted in three Physician Office Laboratory (POL) sites on serum samples at three concentrations over five days. Results were as follows:

| | | | SD (mg/dL) or % CV | |
|---|---|---|---|---|
| Lab | Sample | Mean | Within-Run | Total |
| POL 1 | 1 | 73 | SD 2.5 | SD 2.5 |
| | | | 3.4% | 3.4% |
| POL 2 | 1 | 74 | SD 2.8 | SD 2.8 |
| | | | 3.8% | 3.8% |
| POL 3 | 1 | 73 | SD 2.8 | SD 2.8 |
| | | | 3.9% | 3.9% |
| POL 1 | 2 | 125 | SD 1.6 | SD 1.6 |
| | | | 1.3% | 1.3% |
| POL 2 | 2 | 127 | SD 3.6 | SD 3.6 |
| | | | 2.8% | 2.8% |
| POL 3 | 2 | 124 | SD 2.4 | SD 2.4 |
| | | | 1.9% | 1.9% |
| POL 1 | 3 | 202 | SD 4.6 | SD 4.6 |
| | | | 2.3% | 2.3% |
| POL 2 | 3 | 203 | SD 4.0 | SD 4.4 |
| | | | 2.0% | 2.2% |
| POL 3 | 3 | 202 | SD 6.1 | SD 6.1 |
| | | | 3.0% | 3.0% |

*b. Linearity/assay reportable range:*

Commercial linearity standards were assayed to test that results obtained across the measuring range were linear. The mean value of each set of quadruplicate determinations was determined.

Cholesterol

Percent recoveries ranged from 98% – 100% when testing samples from 2 – 370 mg/dL. The linear regression equation obtained for the study was y = 1.005x – 3.00, $r^2 = 0.9995$. The claimed measuring range is 7 – 370 mg/dL.

HDL Cholesterol

Percent recoveries ranged from 100% – 103% when testing samples from 14 – 140 mg/dL. The linear regression equation obtained for the study was y = 1.002x + 0.70, $r^2 = 0.9993$. The claimed measuring range is 14 – 125 mg/dL.

Triglyceride

Percent recoveries ranged from 95% – 100% when testing samples from 13 – 746 mg/dL. The linear regression equation obtained for the study was y =

1.005x – 4.92, $r^2$ = 0.9996. The claimed measuring range is 15 – 746 mg/dL.

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

Cholesterol - Each lot is calibrated by the manufacturer prior to shipment using material traceable to NIST Standard Reference Material 911.

HDL Cholesterol and Triglyceride - Each lot is calibrated by the manufacturer prior to shipment using material traceable to Reference Material Institute for Clinical Chemistry Standards JCCRM223

The 2-D barcode printed on each cartridge provides the S-40 Clinical Analyzer with lot-specific calibration data.

These methods for cholesterol, HDL cholesterol, and triglyceride have not been tested or certified by the Cholesterol Reference Method Laboratory Network (CRMLN). This information about the CRMLN certification is stated in the labeling.

d. *Detection limit:*

The limit of detection was determined by assaying five low samples (serum samples) and five true blanks (human serum albumin in saline). Testing was carried out over three days on two S40 Clinical Analyzers. Serum samples and true blanks were assayed every day for a total of 60 measurements. The limit of detection was determined to be 7 mg/dL for cholesterol, 6 mg/dL for HDL cholesterol, and 12 mg/dL for triglyceride.

e. *Analytical specificity:*

The sponsor investigated the possibility of interference from ascorbic acid, unconjugated bilirubin, hemolysis, and lipemia. The concentrations of samples tested are presented in the table below.

Cholesterol

| Potential Interferent Concentrations Tested (mg/dL) | Low Cholesterol Concentration Tested (mg/dL) | High Cholesterol Concentration Tested (mg/dL) |
|---|---|---|
| Ascorbic Acid @ 1.6, 3.1, 6.3, 12.5, 25, 50 | 53 | 296 |
| Unconjugated Bilirubin @ 1.6, 3.1, 6.3, 2.5, 25, 50 | 187 | 270 |
| Hemoglobin @ 31.3, 62.5, 125, 250, 500, 1000 | 170 | 255 |

| | | |
|---|---|---|
| Lipemia (Intralipid) @ 62.5, 125, 250, 500, 1000, 2000 | 169 | 251 |

HDL Cholesterol

| Potential Interferent Concentrations Tested (mg/dL) | Low HDL Cholesterol Concentration Tested (mg/dL) | High HDL Cholesterol Concentration Tested (mg/dL) |
|---|---|---|
| Ascorbic Acid @ 1.6, 3.1, 6.3, 12.5, 25, 50 | 15.3 | 48.7 |
| Unconjugated Bilirubin @ 1.6, 3.1, 6.3, 2.5, 25, 50 | 21.3 | 61.7 |
| Hemoglobin @ 31.3, 62.5, 125, 250, 500, 1000 | 20.3 | 56.3 |
| Triglyceride from 94 – 866 mg/dL | 30.0 | 83.3 |

Triglyceride

| Potential Interferent Concentrations Tested (mg/dL) | Low Triglyceride Concentration Tested (mg/dL) | High Triglyceride Concentration Tested (mg/dL) |
|---|---|---|
| Ascorbic Acid @ 1.6, 3.1, 6.3, 12.5, 25, 50 | 79 | 230 |
| Unconjugated Bilirubin @ 1.6, 3.1, 6.3, 2.5, 25, 50 | 99 | 297 |
| Hemoglobin @ 31.3, 62.5, 125, 250, 500, 1000 | 122 | 274 |

The sponsor defined interference as a change greater than 10% or the lowest reportable concentration of the assay. Based on these criteria, the sponsor states the following in the package inserts:

Cholesterol:

No significant interference from ascorbic acid, unconjugated bilirubin, hemolysis, or lipemia.

HDL Cholesterol:

Ascorbic Acid: No significant interference below 25 mg/dL. Ascorbic acid concentrations greater than 25 mg/dL may cause interference. Negative interference (>10%) occurred at 50 mg/dL.

Unconjugated Bilirubin: No significant interference.

Hemolysis: No significant interference below 500 mg/dL. Hemoglobin concentrations greater than 500 mg/dL may cause may cause interference. Negative interference (~11%) occurred at 1000 mg/dL. The labeling states that clear unhemolyzed samples should be used.

Triglyceride: No significant interference below 866 mg/dL.

Triglyceride:

No significant interference from ascorbic acid, unconjugated bilirubin, or hemolysis.

*f. Assay cut-off:*

Not applicable.

2. Comparison studies:

*a. Method comparison with predicate device:*

Cholesterol

A series of 98 serum specimens with cholesterol values ranging from 31 to 335 mg/dL were assayed in-house on the S40 Clinical Analyzer using the S-Test Cholesterol Reagent and on the Ace Clinical Chemistry System using the predicate device. Least-squares regression analysis yielded the following results:

| | |
|---|---|
| **Regression Equation** | Y = 0.978x + 3.5 |
| **Correlation Coefficient** | 0.9832 |
| **Std. Error Est.** | 11.3 |
| **Confidence Interval Slope** | 0.942 to 1.014 |
| **Confidence Interval Intercept** | -3.8 to 10.8 |

Additional method comparison studies were performed at three Physician Office Laboratories (POLs). Operators assayed serum samples ranging from 18 – 334 mg/dL on the S40 Clinical Analyzer and the ACE Clinical Chemistry System. The following linear regression data was obtained using Deming analysis:

| POL | n | Range | Regression Equation | Correlation Coefficient | Standard Error | Confidence Interval Slope | Confidence Interval Intercept |
|---|---|---|---|---|---|---|---|
| A | 53 | 53-315 | y = 0.944x + 0.3 | 0.9585 | 16.7 | 0.868 to 1.021 | -15.7 to 16.2 |
| B | 61 | 18-328 | y = 1.016x + 2.5 | 0.9969 | 4.8 | 0.995 to 1.037 | -1.9 to 6.8 |
| C | 61 | 19-334 | y = 1.031x + 2.9 | 0.9958 | 6.2 | 1.007 to 1.056 | -2.5 to 8.3 |

HDL Cholesterol

A series of 94 serum specimens with HDL Cholesterol values ranging from 15 to 116 mg/dL were assayed on the S40 Clinical Analyzer using the S-Test HDL Reagent and on the Ace Clinical Chemistry System using the predicate device. Least-squares regression analysis yielded the following results:

| | |
|---|---|
| **Regression Equation** | Y = 0.972x + 2.4 |
| **Correlation Coefficient** | 0.9696 |
| **Std. Error Est.** | 4.8 |
| **Confidence Interval Slope** | 0.923 to 1.022 |
| **Confidence Interval Intercept** | -0.5 to 5.2 |

Additional method comparison studies were performed at three Physician Office Laboratories (POLs). Operators assayed serum samples ranging from 17 – 107 mg/dL on the S40 Clinical Analyzer and the ACE Clinical Chemistry System. The following linear regression data was obtained using Deming analysis:

| POL | n | Range | Regression Equation | Correlation Coefficient | Standard Error | Confidence Interval Slope | Confidence Interval Intercept |
|---|---|---|---|---|---|---|---|
| A | 48 | 17-107 | y = 0.949x + 5.2 | 0.9696 | 4.7 | 0.879 to 1.018 | 1.4 to 9.0 |
| B | 56 | 17-101 | y = 0.985x + 1.3 | 0.9915 | 2.2 | 0.950 to 1.020 | -0.7 to 3.2 |
| C | 57 | 17-98 | y = 0.957x + 1.8 | 0.9957 | 1.7 | 0.933 to 0.981 | 0.4 to 3.1 |

Triglyceride

A series of 87 serum specimens with Triglyceride values ranging from 24 to 584 mg/dL were assayed in-house on the S40 Clinical Analyzer using the S-Test Triglyceride Reagent and on the Ace Clinical Chemistry System using the predicate device. Least-squares regression analysis yielded the following results:

| | |
|---|---|
| **Regression Equation** | Y = 1.068x – 17.5 |
| **Correlation Coefficient** | 0.9965 |
| **Std. Error Est.** | 8.7 |
| **Confidence Interval Slope** | 1.049 to 1.088 |
| **Confidence Interval Intercept** | -21.2 to -13.7 |

Additional method comparison studies were performed at three Physician Office Laboratories (POLs). Operators assayed serum samples ranging from 15 – 733 mg/dL on the S40 Clinical Analyzer and the ACE Clinical Chemistry System. The following linear regression data was obtained using Deming analysis:

| POL | n | Range | Regression Equation | Correlation Coefficient | Standard Error | Confidence Interval Slope | Confidence Interval Intercept |
|---|---|---|---|---|---|---|---|
| A | 47 | 15-627 | y = 0.966x - 14.0 | 0.9958 | 10.0 | 0.940 to 0.993 | -19.0 to -9.0 |
| B | 50 | 17-733 | y = 1.038x - 2.7 | 0.9990 | 6.6 | 1.024 to 1.051 | -5.8 to 0.5 |
| C | 48 | 19-707 | y = 1.057x - 2.9 | 0.9963 | 11.9 | 1.030 to 1.084 | -8.7 to 2.9 |

*b. Matrix comparison:*

Cholesterol

A study was performed by comparing cholesterol concentrations on 29 paired samples drawn from the same patients in serum and lithium heparin plasma tubes at a clinical laboratory. All specimens were assayed on the S40 Clinical Analyzer using the S-Test cholesterol reagent. The serum results ranged from 22 to 249 mg/dL. Least-square regression analysis yielded the following results:

| | |
|---|---|
| **Regression Equation** | y = 1.015x – 4.1 |
| **Correlation Coefficient** | 0.9968 |
| **Std. Error Est.** | 4.4 |
| **Confidence Interval Slope** | 0.982 to 1.047 |
| **Confidence Interval Intercept** | -9.1 to 1.0 |

HDL Cholesterol

A study was performed by comparing HDL cholesterol concentrations on 36 paired samples drawn from the same patients in serum and lithium heparin plasma tubes at a clinical laboratory. All specimens were assayed on the S40 Clinical Analyzer using the S-Test HDL cholesterol reagent. The serum results ranged from 14 to 124 mg/dL. Least-square regression analysis yielded the following results:

| | |
|---|---|
| **Regression Equation** | y = 1.020x – 1.1 |
| **Correlation Coefficient** | 0.9890 |
| **Std. Error Est.** | 3.4 |
| **Confidence Interval Slope** | 0.967 to 1.073 |
| **Confidence Interval Intercept** | -3.6 to 1.5 |

Triglyceride

A study was performed by comparing HDL triglyceride concentrations on 30 paired samples drawn from the same patients in serum and lithium heparin plasma tubes at a clinical laboratory. All specimens were assayed on the S40 Clinical Analyzer using the S-Test HDL triglyceride reagent. The serum results ranged from 36 to 572 mg/dL. Least-square regression analysis yielded the following results:

| | |
|---|---|
| **Regression Equation** | y = 0.957x + 0.0 |
| **Correlation Coefficient** | 0.9849 |
| **Std. Error Est.** | 24.0 |
| **Confidence Interval Slope** | 0.892 to 1.021 |
| **Confidence Interval Intercept** | -16.4 to 16.5 |

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):

4. Clinical cut-off:

   Not applicable. Clinical studies are not typically submitted for this device type.

5. Expected values/Reference range:

   Reference ranges are taken from the Third Report of National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Cholesterol in Adults (Adult Treatment Panel III); Executive Summary, 2002.

| Total Cholesterol (mg/dL) | |
|---|---|
| < 200 | Desirable |
| 200 – 239 | Borderline |
| ≥ 240 | High |

| HDL Cholesterol (mg/dL) | |
|---|---|
| < 40 | Low |
| ≥ 60 | High |

| Triglyceride (mg/dL) | |
|---|---|
| < 150 | Normal |
| 150 – 199 | Borderline High |
| 200 – 499 | High |
| ≥ 500 | Very High |

## 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.