Quest Diagnostics

TRAINING UPDATE

Lab Location:	GEC	**Date Distributed:**	7/19/2012
Department:	Core	**Due Date:**	8/15/2012

DESCRIPTION OF PROCEDURE REVISION

Name of procedure:

Ethyl Alcohol by Dimension® Chemistry Analyzer GEC.C29 v001

Description of change(s):

Section	Reason
3.2	Delete Room Temperature specimen storage to match PI
5.2	Correct Storage Temperature to match PI

Document your compliance with this training update by taking the quiz in the MTS system.

Approved draft for training (version 001)

Technical SOP

Title	**Ethyl Alcohol by Dimension® Chemistry Analyzer**
Prepared by	Ashkan Chini Date: 5/10/2011
Owner	Jean Buss, Robert SanLuis Date: 5/10/2011

Laboratory Approval	**Local Effective Date:**	
Print Name and Title	**Signature**	**Date**
Refer to the electronic signature page for approval and approval dates.		

Annual Review		
Print Name	**Signature**	**Date**

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1. TEST INFORMATION

Assay	Method/Instrument	Local Code
Ethyl Alcohol	Dimension® Chemistry Analyzer	ALCO

Synonyms/Abbreviations
ALC, Ethyl Alcohol, ETOH

Department
Chemistry

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2. ANALYTICAL PRINCIPLE

Alcohol dehydrogenase (ADH) catalyzes the oxidation of ethanol to acetaldehyde, with the simultaneous reduction of nicotinamide adenine dinucleotide (NAD). An alkaline pH and an aldehyde trapping agent force the reaction to one mole of NADH for each mole of alcohol present. The absorbance due to NADH (and thus the alcohol concentration) is determined using a two-filter (340-383 nm) endpoint technique.

$$\text{Ethanol} + \text{NAD} \xrightarrow{\text{ADH}} \text{Acetaldehyde} + \text{NADH} + H^+$$

(nonabsorbing at 340 nm) (absorbs at 340 nm)

$$\text{Acetaldehyde} + \text{Tris} \longrightarrow \text{Complex}$$

3. SPECIMEN REQUIREMENTS

3.1 Patient Preparation

Component	Special Notations
Fasting/Special Diets	N/A
Specimen Collection and/or Timing	Normal procedures for collecting and storing serum and plasma may be used for samples to be analyzed by this method.
Special Collection Procedures	Use non-alcohol germicidal solution to cleanse the skin
Other	N/A

3.2 Specimen Type & Handling

Criteria		
Type -Preferred **-Other Acceptable**	Serum Plasma (Heparin)	
Collection Container	Serum: Red top tube no additives Plasma: Green top tube	
Volume - Optimum **- Minimum**	1.0 mL 0.5 mL	
Transport Container and Temperature	Collection container or Plastic vial at room temperature	
Stability & Storage Requirements	Room Temperature:	Not recommended
	Refrigerated:	(2-8°C) 24 hours
	Frozen:	Not recommended
Timing Considerations	Tubes that have been open for any great length of time are unacceptable. Open and process samples in STAT mode.	

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Criteria	
Unacceptable Specimens & Actions to Take	Specimens that are unlabeled, improperly labeled, or those that do not meet the stated criteria are unacceptable. Request a recollection and credit the test with the appropriate LIS English text code for "test not performed" message. Examples: Quantity not sufficient-QNS; Wrong collection-UNAC. Document the request for recollection in the LIS.
Compromising Physical Characteristics	Fibrin, red cells. Specimens should be free of particulate matter. Allow to clot completely prior to centrifugation. Gross hemolysis. Reject sample and request a recollection. Credit the test with the appropriate LIS English text code explanation of HMT (Specimen markedly hemolyzed)
Other Considerations	None

4. REAGENTS

Refer to the Material Safety Data Sheet (MSDS) supplied with the reagents for complete safety hazards. Refer to the section in this procedure covering "SAFETY" for additional information.

4.1 Reagent Summary

Reagents	Supplier & Catalog Number	Quantity
Ethyl Alcohol	Siemens, Flex® reagent cartridge, Cat. No. DF18	4 Flex/carton

4.2 Reagent Preparation and Storage

NOTES: Date and initial all reagents upon opening. Each container must be labeled with (1) substance name, (2) lot number, (3) date of preparation, (4) expiration date, (5) initials of tech, (6) any special storage instructions; check for visible signs of degradation.
Refer to the Material Safety Data Sheet (MSDS) for a complete description of hazards. If a specific hazard is present, it will be noted in this procedure when the hazard is first encountered in a procedural step.

Irritating to eyes, respiratory system and skin.
May cause sensitization by skin contact.

Reagent	**Ethyl Alcohol**
Container	Reagent cartridge
Storage	Store at 2-8°C
Stability	• Reagent is stable until expiration date stamped on the reagent cartridges. • Sealed or unhydrated cartridge wells on the instrument are stable for 30 days. • Once wells 1 – 8 have been entered by the instrument, they

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	are stable for 5 days.
Preparation	Reagents are supplied ready for use. No additional preparation is required.

5. CALIBRATORS/STANDARDS

5.1 Calibrators/Standards Used

Calibrator	Supplier and Catalog Number
Alcohol Calibrator	Siemens Dimension®, Cat. No. DC37A

5.2 Calibrator Preparation and Storage

NOTE: Date and initial all calibrators upon opening. Each container must be labeled with (1) substance name, (2) lot number, (3) date of preparation, (4) expiration date, (5) initials of tech (6) any special storage instructions; check for visible signs of degradation.

Calibrator	Alcohol Calibrator
Preparation	• No preparation required. • Wrap the ampule with a towel to avoid the potential of hand injury. • Remove ampule top by applying pressure above the score line. • Transfer contents of the ampule to the sample cup.
Storage/Stability	• Store at 2-25°C. • The unopened reagents are stable until the expiration date printed on the label. • Opened ampules should be used immediately. Unused portion should be discarded.

5.3 Calibration Parameter

Criteria	Special Notations
Reference Material	Alcohol Calibrator
Assay Range	0–300 mg/dL
Suggested calibration level	0, 100, 300 mg/dL
Frequency	• Every new reagent cartridge lot. • Every 3 months for any one lot. • When major maintenance is performed on the analyzer. • When control data indicates a significant shift in assay.
Calibration Scheme	Three levels in triplicate.
Assigned Coefficients	C_0 –2.600 C_1 0.323

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5.4 Calibration Procedure

1. From Operating Menu press F5:Process Control press F1: Calibration Enter Password press F2: SETUP and RUN
2. Select the test method to be calibrated - if lot number is incorrect Press F1: Other Lot
3. Enter all information on screen
4. Press F8: QC yes/no to change to yes
5. Press F4: Assign cups If additional methods need to be calibrated, select the method.
6. Press F7: Load/run
7. Load cups into assigned position
8. Press F4: RUN

5.5 Tolerance Limits

IF……	**THEN……**
If result fall within assay-specific specification, and QC values are within acceptable limits,	proceed with analysis
If result falls outside assay-specific specification, or QC values are out of Acceptable limits,	troubleshoot the assay and/or instrument and repeat calibration

6. QUALITY CONTROL

6.1 Controls Used

Controls	Supplier and Catalog Number
Liquichek Ethanol/Ammonia Control Levels 1, 2 & 3	Bio-Rad Laboratories Catalog # 544, 545 & 546

6.2 Control Preparation and Storage

NOTE: Date and initial all controls upon opening. Each container should be labeled with (1) substance name, (2) lot number, (3) date of preparation, (4) expiration date, (5) initials of tech, and (6) any special storage instructions; check for visible signs of degradation.

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Control	Liquichek Ethanol/Ammonia Control Levels 1, 2 & 3
Preparation	No preparation required. Allow the control to reach room temperature (18-25°C) and swirl gently to ensure homogeneity. After each use, promptly replace the stopper and return to 2-8°C storage.
Storage/Stability	Open controls are stable for 20 days at 2-8°C. Unopened controls are stable until the expiration date at 2-8°C.

6.3 Frequency

Analyze all levels of QC material after every calibration and each day of testing (notated on the QC frequency sheets posted on the instruments).

Refer to the Dimension® QC Schedule in the Laboratory policy Quality Control Program and in the Dimension® Quick Reference Guide.

6.4 Tolerance Limits

Step	Action
1	Acceptable ranges for QC are programmed into the Laboratory Information System (LIS), and may be posted near the instrument for use during computer downtime.
2	**Run Rejection Criteria** • Anytime the established parameters are exceeded (if one QC result exceeds 2 SD), the run is considered out of control (failed) and patient results must not be reported. • The technologist must follow the procedure in the Laboratory QC Program to resolve the problem.
3	**Corrective Action**: • All rejected runs must be effectively addressed through corrective action. Steps taken in response to QC failures must be documented. Patient samples in failed analytical runs must be reanalyzed according to the Laboratory QC Program. Supervisors may override rejection of partial or complete runs only with detailed documentation and criteria for overrides that are approved by the Medical Director. Consult corrective action guidelines in Laboratory QC Program. Follow corrective action guidelines in the Laboratory QC Program. • Corrective action documentation must follow the Laboratory Quality Control Program.
4	**Review of QC** • QC must be reviewed weekly by the Group Lead or designee and monthly by the Supervisor/Manager or designee. • If the SD and/or CV are greater than established ranges, investigate

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Step	Action
	the cause for the imprecision and document implementation of corrective actions.

6.5 Review Patient Data

Technologist must review each result print-out for error messages. Refer to the Dimension® system manual "Error messages" section for troubleshooting. Check for unusual patterns, trends, or distributions in patient results (such as an unusually high percentage of abnormal results). Resolve any problems noted before issuing patient reports.

6.6 Documentation

- QC tolerance limits are programmed into the instrument and the LIS. The LIS calculates cumulative mean, SD and CV and stores all information for easy retrieval.
- Quality control records are reviewed daily at the bench, weekly by the Lead Technologist or designee, and monthly by the Supervisor/Manager or designee.
- Refer to complete policies and procedures for QC documentation and for record retention requirements in the Laboratory QC Program.

6.7 Quality Assurance Program

- Each new lot number of reagent or new shipment of the same lot of reagent must be tested with external control materials and previously analyzed samples. Performance of the new lot must be equivalent to the previous lot; utilize published TEA for acceptability criteria.
- Training must be successfully completed and documented prior to performing this test. This procedure must be incorporated into the departmental competency assessment program.
- The laboratory participates in CAP proficiency testing. All proficiency testing materials must be treated in the same manner as patient samples.
- Monthly QC must be presented to the Medical Director or designee for review and signature.
- Monthly QC mean and SD are sent to Bio-Rad Laboratories for peer group comparison.
- Consult the Laboratory QC Program for complete details.

7. EQUIPMENT and SUPPLIES

7.1 Assay Platform

Dimension® Chemistry Analyzer

7.2 Equipment

- Refrigerator capable of sustaining 2–8°C.
- Freezer capable of sustaining range not to exceed -20 to -70°C.
- Centrifuge

7.3 Supplies

- Plastic serum tubes and serum cups
- Purified water (Millipore® or equivalent)
- Calibrated pipettes and disposable tips

8. PROCEDURE

ALC Flex® reagent cartridge Cat. No. DF18 is required to perform this test.

Ethyl Alcohol is performed on the Dimension® clinical chemistry system after the method is calibrated (see Reference Material in Calibration section) and Quality Controls are acceptable.

NOTE: For all procedures involving specimens, buttoned lab coats, gloves, and face protection are required minimum personal protective equipment. Report all accidents to your supervisor.

The package insert for a new lot of kits must be reviewed for any changes before the kit is used. A current Package Insert is included as a Related Document.

8.1	Instrument Set-Up Protocol
1.	For instrument set up and operation: Refer to Startup and Maintenance, Siemens Dimension® procedure.
2.	Check reagent inventory
3.	Sampling, reagent delivery, mixing, processing, and printing of results are automatically performed by the Dimension® system. For details of the automated parameters, see below under “Test conditions.”

8.2	Specimen/Reagent Preparation
1.	Centrifuge the specimens.
2.	For sites with StreamLab (Lynx): **Qualifying** samples are loaded via the Dimension® Lynx System which automatically routes specimens to the instruments. Refer to the Dimension® Streamlab® Analytical Workcell (Lynx) System manual for instructions.
3.	Alternatively, specimens are placed in color-coded Dimension® segments for analysis by the instrument. Refer to the Sample Processing, Siemens Dimension® procedure. The sample container (if not a primary tube) must contain sufficient quantity to accommodate the sample volume plus 50 µL of dead volume. Precise container filling is not required.

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8.3	Specimen Testing
1.	For QC placement and frequency, refer to the Dimension® QC Schedule in the Laboratory QC Program.
2.	Follow the instructions, outlined in the Dimension® Operators Manual
3.	The instrument reporting system contains error messages to warn the user of specific malfunctions. Results followed by such error messages should be held for follow-up. Refer to the Dimension® system manual "Error messages" section for troubleshooting.
4.	Follow protocol in Section 10.5 "Repeat criteria and resulting" for samples with results above or below the Analytical Measurement Range (AMR). Repeat critical values and document according to Critical Values procedure. Investigate any failed delta result and repeat, if necessary.
5.	Append the appropriate English text code qualifier messages to any samples requiring a comment regarding sample quality and/or any other pertinent factors.

Test Conditions	
Sample Size:	3 µL
Reagent 1 Volume:	190 µL
Reagent 2 Volume:	90 µL
Reagent 3 Volume:	25 µL
Diluent Volume:	192 µL
Temperature:	37° C
Wavelength:	340 and 383 nm
Type of Measurement:	Bichromatic endpoint

9. CALCULATIONS

The instrument automatically calculates and prints the concentration of Alcohol in mg/dL.

10. REPORTING RESULTS AND REPEAT CRITERIA

10.1 Interpretation of Data

None required

10.2 Rounding

No rounding is necessary. Instrument reports results as a whole number.

10.3 Units of Measure

mg/dL

10.4 Clinically Reportable Range (CRR)

5 - 900 mg/dL

10.5 Repeat Criteria and Resulting

All repeats must replicate the original result within the total allowable error (TEa) of the assay. Refer to TEa listing for specific information.

Values that fall within the AMR or CRR may be reported without repeat. Values that fall outside these ranges must be repeated

IF the result is …	THEN…
0 mg/dL	Assure there is sufficient sample devoid of bubbles, cellular debris, and/or fibrin clots. Report as: <5 mg/dL
≥300 mg/dL	**On Board Automated Dilution:** Results ≥300 mg/dL will automatically have repeat testing performed into the instrument using dilution factor of 1.5. No multiplication is necessary. Append the result with code –REP.
>450 mg/dL	**Manual Dilution:** Using the primary tube, make the smallest dilution possible to bring the raw data within the AMR. Maximum allowable dilution: x 3 **Diluent**: Purified water. Enter dilution factor as a whole number on the "Enter Sample Data" screen. Report the assay with code of –REP.
>900 mg/dL	If the recommended dilution does not give results within the clinically reportable range, report as: ">900 mg/dL-REP" Bring to the attention of your supervisor prior to releasing result.

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Message	Code
Verified by repeat analysis	Append –REP to the result.

11. EXPECTED VALUES

11.1 Reference Ranges

<5 mg/dL

11.2 Critical Values

>400 mg/dL

11.3 Priority 3 Limit(s)

None established

12. CLINICAL SIGNIFICANCE

Alcohol (ethyl alcohol, ethanol) is the most frequently performed medico legal test, and is the most common toxic substance encountered. In addition to beverages, products containing alcohol in significant amounts include mouthwashes, colognes, and medicinal preparations. Measurements of alcohol levels are used to determine legal impairment, for forensic

purposes, in the diagnosis and treatment of alcohol dependency and in emergency settings to detect alcohol poisoning.

Alcohol's deleterious effects are well documented. It has been linked with birth defects (fetal alcohol syndrome), cardiac conditions, high blood pressure, liver disease, and mental deterioration. It is by far the leading cause of death from hepatic failure. Additionally, alcohol-induced behavior is a contributing factor in the majority of accidents and murders.

Within approximately one hour of ingestion, alcohol will have permeated all tissues of the body in proportion to water content. Some alcohol is absorbed while in the stomach, but the principal site of absorption is the upper portion of the small intestine. Rate of absorption is dependent upon emptying time of the stomach, which is subject to various influences. Since alcohol distributes evenly throughout the body water, its concentration in blood following a known dose may be estimated indirectly by measuring concentrations in urine, serum, or plasma.

About 95% of the elimination of alcohol from the body is accomplished by metabolism in the liver. The remainder is excreted unchanged by the lungs, kidneys, and in the feces. Alcohol is rapidly metabolized so that a moderate dose will clear from the blood in approximately one hour.

13. PROCEDURE NOTES

- **FDA Status:** FDA Approved/cleared
- **Validated Test Modifications:** None

The instrument reporting system contains error messages to warn the operator of specific malfunctions. Any report slip containing such error messages should be held for follow-up. Refer to you Dimension Operator's Guide.

A system malfunction may exist if the following 5-test precision is observed:

Concentration	S.D.
100 mg/dL	> 3 mg/dL
300 mg/dL	> 6 mg /dL

14. LIMITATIONS OF METHOD

14.1 Analytical Measurement Range (AMR)

0 – 300 mg/dL

14.2 Precision

Material	Mean mg/dL	Standard Deviation (%CV)	
		Within-run	Total
Whole Blood Supernatant	30.0	0.71	1.68

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Plasma Pool	93	1.80	4.18
Calibrator	98.8	1.19	2.09
Sigma ethanol control	188.2	2.02	3.20

14.3 Interfering Substances

- Isopropyl alcohol of 51 mg/dL increases the ethyl alcohol by 11 mg/dL at an ethyl alcohol concentration of 100 mg/dL; Isopropyl alcohol of 254 mg/dL increases the ethyl alcohol by 44 mg/dL at an ethyl alcohol concentration of 100 mg/dL.
- At ethyl alcohol concentration of 100 mg/dL butanol at 250 mg/dL increases the ALC result by 26.5% and n-propanol at 500 mg/dL increases the ALC result by 57.7%.
- Bilirubin (unconjugated) of 40 mg/dL will decrease an ALC result of 93 mg/dL by 11%.
- Lipemia of 3000 mg/dL will increase an ALC result of 92 mg/dL by 16%.

HIL Interference:
The ALC method was evaluated for interference from hemolysis, icterus and lipemia according to CLSI/NCCLS EP7-P. Bias, defined as the difference between the control sample (does not contain interferent) and the test sample (contains interferent), is shown in the table below. Bias exceeding 10% is considered "interference".

Substance tested	**Test Concentration SI Units**	**ALC Concentration mg/dL**	**Bias %**
Hemoglobin (hemolysate)	1000 mg/dL (monomer)	93	<10
Bilirubin (unconjugated)	20 mg/dL	93	<10
Lipemia (Intralipid®)	1000 mg/dL	92	<10

14.4 Clinical Sensitivity/Specificity/Predictive Values

Not available.

15. SAFETY

The employee has direct responsibility to avoid injury and illness at work. Nearly all harmful exposures to infectious substances and chemicals, and other injuries, can be avoided with effective training and consistent safe work practices.

Become familiar with the Environmental Health and Safety (EHS) Manual to learn the requirements on working safely and protecting the environment from harm. Although lab work typically focuses on the hazards of working with specimens and chemicals, we must also control other important hazards.

- Slips, trips, and falls cause many serious injuries. Please ensure that spills are cleaned quickly (to avoid slippery floors) and that you can see and avoid obstacles in your path.

- Ergonomic injuries result from performing tasks with too much repetition, force, or awkward position. Ergonomic injuries include strains and back injuries. Learn about ergonomic hazards and how to prevent this type of injury.
- Scratches, lacerations, and needlesticks can result in serious health consequences. Attempt to find ways to eliminate your risk when working with sharp materials.

Report all accidents and injuries immediately to your supervisor or the business unit Environmental Health and Safety Manager or Specialist.

16. RELATED DOCUMENTS

1. Dimension® Clinical Chemistry System Operator's Manual
2. Dimension® Calibration/Verification Procedure
3. Dimension® Cal Accept Guidelines
4. Dimension® Calibration summary
5. Sample Processing, Siemens Dimension® procedure
6. Start up and Maintenance, Siemens Dimension® procedure
7. Laboratory Quality Control Program
8. QC Schedule for Siemens Dimension®
9. Laboratory Safety Manual
10. Material Safety Data Sheets (MSDS)
11. Siemens Dimension® Limits Chart
12. Quest Diagnostics Records Management Procedure
13. Dimension® Error Messages Chart
14. Centrifuge Use, Maintenance and Functions Checks (Lab policy)
15. Hemolysis, Icteria and Lipemia Interference (Lab policy)
16. Repeat Testing Requirements (Lab policy)
17. Critical Values (Lab policy)
18. Current Allowable Total Error Specifications at http://questnet1.qdx.com/Business_Groups/Medical/qc/docs/qc_bpt_tea.xls
19. Current package insert ALC Flex® Reagent Cartridge DF18

17. REFERENCES

1. Package Insert, ALC Flex® Reagent Cartridge DF18, Siemens Healthcare Diagnostics Inc., 08/19/2008.
2. Package insert, Alcohol Calibrator DC37A, Siemens Healthcare Diagnostics Inc., 04/2008.
3. Package insert, Liquichek Ethanol/Ammonia Control, Bio-Rad Laboratories, 11/2009.

18. REVISION HISTORY

Version	Date	Section	Reason	Reviser	Approval
			Supersedes SOP C105.001		
000	06/14/12	3.2	Delete Room Temperature specimen storage to match PI	J Buss	J Buss, RSL
000	06/14/12	5.2	Correct Storage Temperature to match PI	J Buss	J Buss, RSL
000	06/14/12	10.5	Remove code QNSR	L Barrett	J Buss, RSL

19. ADDENDA

None