



Airborne Labs International

22C World's Fair Drive Somerset, NJ 08873 T: 732-302-1950 F: 732-302-3035
E-mail: Sales@airbornelabs.com Website: www.airbornelabs.com

CO₂ Sampling & Laboratory Analysis

Liquid & Gas Sampling Techniques including No-Haz Sampling Kits

February
2023

Mark Taylor, Don Pachuta Ph.D., & Chandler Stryker



Why Test?

Brand Protection and Health Safety

- Impurities in Carbon Dioxide can affect the flavor of the beverage
- Impurities in concentrations above the guideline could have health effects on the consumer
- It is the responsibility of the gas supplier to identify, measure, and control the levels of impurities listed in the ISBT guideline/Coca-Cola guideline to produce beverage-grade quality CO₂
- **TRUST BUT VERIFY**
- Beverage manufacturers have an independent responsibility to ensure that their suppliers consistently meet this desired purity level



Specifications & Rationale

| Parameter | Guideline Limit | Rationale |
|---|---|----------------------|
| Purity: | 99.9 % v/v min. | Process |
| Moisture (H2O): | 20 ppm v/v max. | Process |
| Oxygen (O2): | 30 ppm v/v max. | Sensory |
| Carbon Monoxide (CO): | 10 ppm v/v max. | Process & Regulatory |
| Ammonia (NH3): | 2.5 ppm v/v max. | Process |
| Nitrogen Monoxide (NO): | 2.5 ppm v/v max. | Regulatory |
| Nitrogen Dioxide (NO2): | 2.5 ppm v/v max. | Regulatory |
| Non-volatile Residue (NVR): | 10 ppm w/w max. | Sensory |
| Non-volatile Organic Residue (NVOR): | 5 ppm w/w max. | Sensory |
| Methanol (MeOH): | 10 ppm v/v max. | Process |
| Total Volatile Hydrocarbons (THC as Methane): | 50 ppm v/v max. (including 20 ppm v/v max. as total non-methane hydrocarbons [TNMHC]) | Sensory |
| Acetaldehyde (AA): | 0.2 ppm v/v max. | Sensory |
| Aromatic Hydrocarbon (AHC): | 20 ppb v/v max. | Regulatory |
| Total Sulfur Content (TSC as S exclude Sulfur Dioxide): | 0.1 ppm v/v max. | Sensory |
| Sulfur Dioxide (SO2): | 1 ppm v/v max. | Sensory |
| Odor of Solid CO2 (Snow): | No foreign odor | Sensory |
| Appearance of Solid CO2 (Snow): | No foreign appearance | Sensory |
| Odor & Taste in Water: | No foreign odor or taste | Sensory |
| Appearance in Water: | No color or turbidity | Sensory |

Sensory:

Any attribute that negatively impacts a beverage's taste, appearance, or odor.

Process:

Any attribute that defines a key parameter in a controlled process and an important consideration in the beverage industry.

Regulatory:

Any attribute whose limit is set by a governing regulatory agency and related to food safety.



Techniques for Sampling

NON-HAZARDOUS GAS SHIPMENT

FINAL PRODUCT NO-HAZ SAMPLING KIT



VPR-HF
(VAPORIZER)



SNOWQUIK 1.3B
(SNOW HORN)

HAZARDOUS LIQUID CO₂ SHIPMENT

FINAL PRODUCT 1L SAMPLING KIT



FINAL PRODUCT 5.9L SAMPLING KIT



Final Product CO₂ “No-Haz” Sampling Kit

- Why is this kit Non-Hazardous?
- Per International Air Transport Association (IATA), samples are not dangerous goods when:
 - Division 2.2 gas (not compressed or Liquefied in the cylinder) that is non-flammable
 - Pressure is below 200kPa (29 psig, 43.5 psia per section 3.2.0.4.1
 - Gas Samples under 75kg for passenger aircraft and under 150kg for cargo aircraft
 - Pressure is below 200kPa (29 psig, 43.5 psia per section 3.2.0.4.1
 - This kit is CO₂ Div 2.2 at no more than 25 psig and no more than 0.05kg of gas sample.



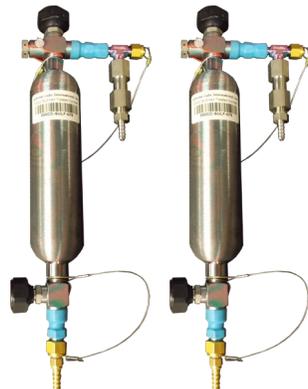
Final Product CO₂ No-Haz Kit

Final Product CO₂ “No-Haz” Sampling Kit Components

- A complete Final Product Test Program requires:
 - (2) 2L Gas Sampling Bags
 - (2) 300cc Minicyl
 - (1) 1L NVR Can with a minimum of 250g of snow (sublimed prior to shipping)



Beverage Grade Certified Sample Bags



Siliconert Passivated 300cc No-Haz Minicyl



Mirror Polished NVR Can



Final Product CO₂ No-Haz Kit

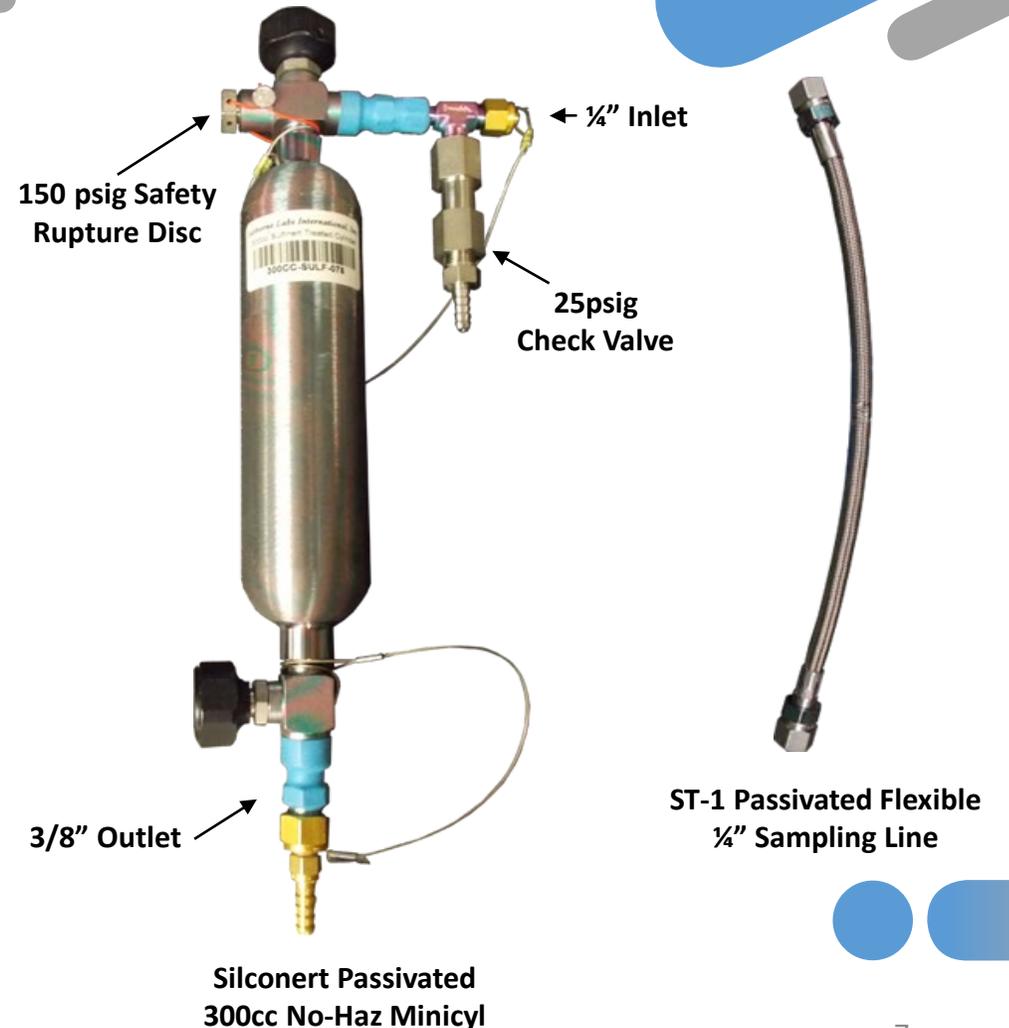
Available for
Rental or
Purchase



Final Product CO₂ “No-Haz” Sampling Kit

300cc No-Haz Cylinder

- All wetted parts are Silconert passivated to prevent trace impurity absorption.
- ¼” Swagelok tube (compression) inlet
- 25 psig check valve to ensure pressure is under the IATA requirement of 29 psig
- Safety Rupture Disc (150 psig) to keep the 1800 psig cylinder from being over-pressurized
- ¾” Outlet connection to prevent check valve bypassing and improper filling



Final Product CO₂ “No-Haz” Sampling Kit

Certified Beverage Grade Polybags

- ISBT Beverage Grade True Blue 2L Polybags come with a Certificate of Purity Lot Analysis
- Designed for high-purity beverage grade CO₂ and other high-purity gas sampling & testing applications
- Sold individually or in cases of 10
- Sold with single valve or dual valve (flow-through) configuration.
- The SHA-T accessory allows for an easy, reliable purge, and fill process



Certified Beverage Grade Polybag



SHA-T



Final Product CO₂ “No-Haz” Sampling Kit

Required Accessories

Vaporizing Pressure Regulator – High Flow

- Silconert passivated Liquid CO₂ Flash Vaporizer to supply vaporized sample gas from storage tanks to No-Haz sampling kits or Analytical Systems



VPR-HF

SnowQuik 1.3B

- Simple, Compact, Versatile snowmaker that generated approximately 300g+ of snow in 1 minute for NVR/NVOR and Sensory tests.



SnowQuik 1.3B



Fibreless Bag



NVR Can



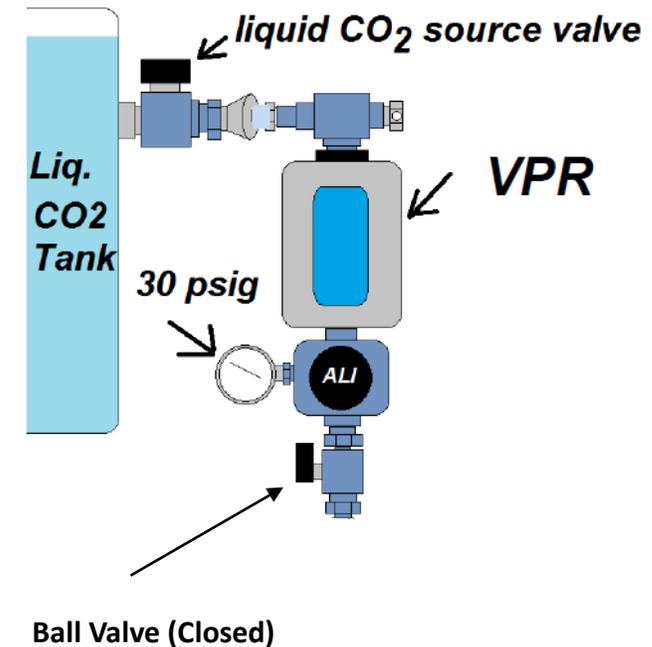
Digital Scale 2kg



Final Product CO₂ “No-Haz” Sampling Kit

2L Polybags – Sampling Liquid CO₂

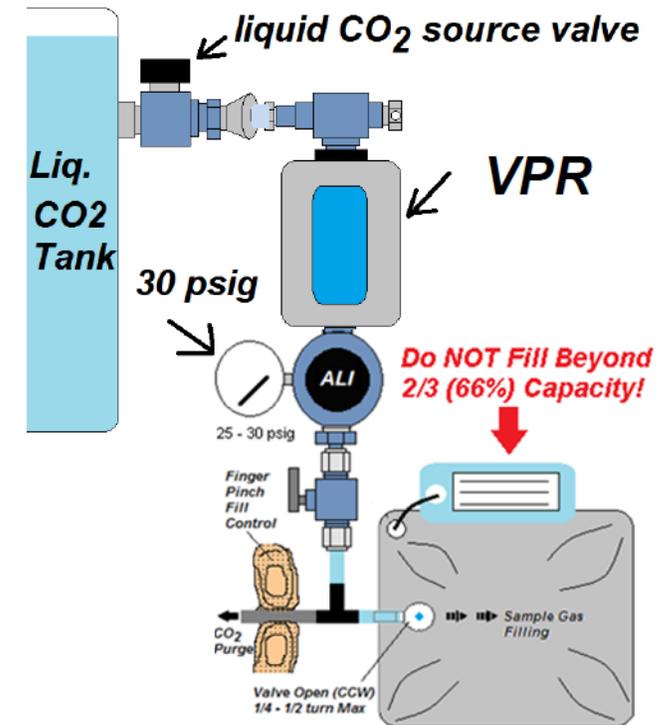
- All samples are taken from the same liquid phase CO₂ sampling port (cylinders, polybags, and snow).
- Ensure the sampling area is well-ventilated and personal safety gear is worn
- Plug in the VPR-HF (vaporizer) and allow it to warm up for 20 minutes.
- Attached the ¼” VPR-HF Inlet to the liquid CO₂ source valve with outlet pressure regulator and ball valve closed.



Final Product CO₂ “No-Haz” Sampling Kit

2L Polybags – Sampling Liquid CO₂

- Open the Liquid CO₂ source valve & adjust the VPR-HF to deliver between 25-30 psig
- Open the VPR-HF ball valve and purge the system for 15 seconds.
- While purging, attach a polybag to the still FEP end of the SHA T-Fitting
- Open the polybag valve ¼ - ½ of a turn
- Fill gas to ¾ of the bag, detach, gently squeeze to empty. This removes all Air gases.
- Refill the bag to 2/3 or 66%. Close the valve and repeat with the 2nd bag.
- Fill out sample Identification Cards with company, time and location information

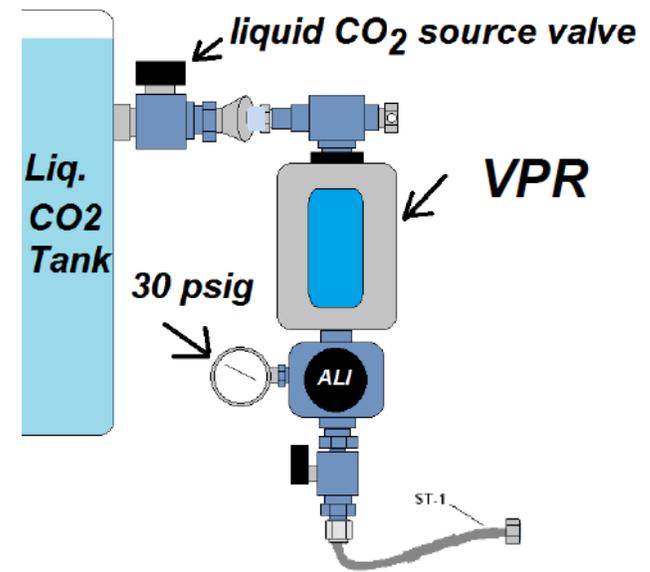


Overfilling the polybag can cause it to burst during transport

Final Product CO₂ “No-Haz” Sampling Kit

300cc Passivated Minicyl – Sampling Liquid CO₂

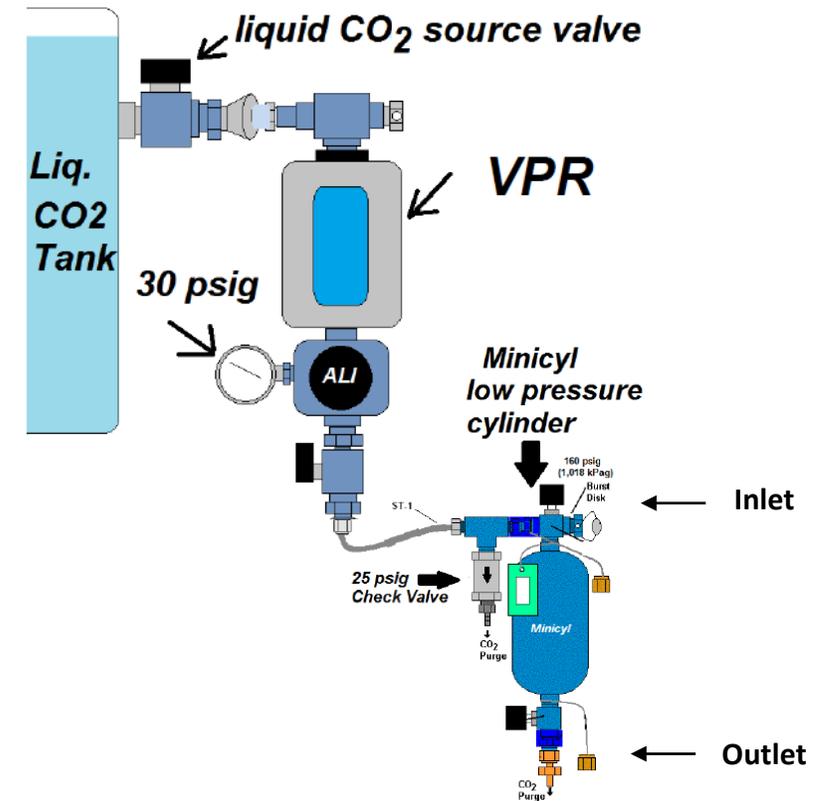
- While still flushing the VPR-HF, detach the SHA T-Fitting and attached the ST-1 transfer line. Purge 15 seconds.



Final Product CO₂ “No-Haz” Sampling Kit

300cc Passivated Minicyl – Sampling Liquid CO₂

- Attach the minicyl’s ¼” Inlet fitting to the ¼” passivated ST-1
- The sample will now purge from the VPR-HF, through the ST-1, and out of the minicyl’s check valve
- Fully open the minicyl’s Inlet Valve, and followed by the minicyl’s Outlet Valve
- The flow will cease to exit the Check Valve and now purge through the minicyl and out the Outlet Valve
- Purge for 5 minutes to remove any potential Air gases



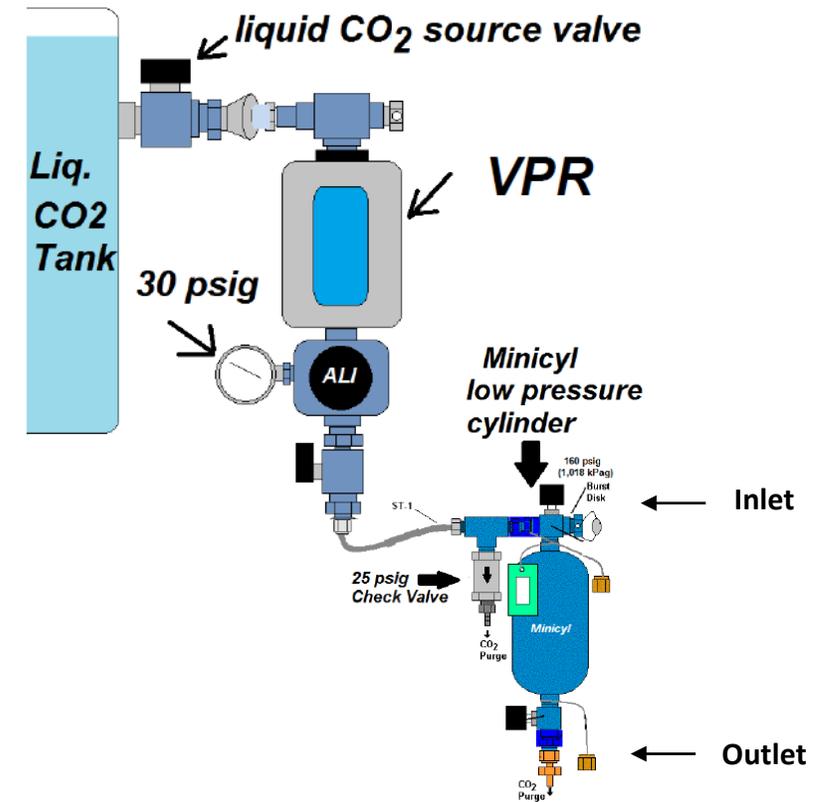
Sampling Liquid CO₂ with VPR-HF into a No-Haz 300cc Minicyl



Final Product CO₂ “No-Haz” Sampling Kit

300cc Passivated Minicyl – Sampling Liquid CO₂

- After purging for 5 minutes
 - Close the Outlet Valve on the minicyl
 - The flow will now exit the Check Valve, confirming that the minicyl is pressurized to 25 psig
 - Close the Inlet Valve on the minicyl, securing the sample within the passivate minicyl
 - Fill out sample Identification Cards with company, time, and location information
 - Repeat these steps for the 2nd minicyl.



YouTube
Training
Video

Sampling Liquid CO₂ with VPR-HF into a No-Haz 300cc Minicyl

Final Product CO₂ “No-Haz” Sampling Kit SnowQuik 1.3B for NVR/NVOR & Sensory Tests

- Inspect the NVR can’s shiny interior for cleanliness
- Weigh the empty (lidless) NVR can with an appropriate balance on a level surface
- Record this “empty” wt (g) on the can’s ID tag



NVR Can

Digital Scale 2kg



Sampling Liquid CO₂ with SnowQuik 1.3B
For NVR/NVOR

Final Product CO₂ “No-Haz” Sampling Kit SnowQuik 1.3B for NVR/NVOR & Sensory Tests

- Inspect the NVR can’s shiny interior for cleanliness
- Weigh the empty (lidless) NVR can with an appropriate balance on a level surface
- Record this “empty” wt (g) on the can’s ID tag
- Remove the VPR-HF from the Liquid CO₂ source valve



NVR Can

Digital Scale 2kg



Sampling Liquid CO₂ with SnowQuik 1.3B
For NVR/NVOR

Final Product CO₂ “No-Haz” Sampling Kit SnowQuik 1.3B for NVR/NVOR & Sensory Tests

- Inspect the Cone & Snow Bags for cleanliness then attach to the Liquid CO₂ Source Valve using an appropriate mating fitting
- Slightly open the Liquid CO₂ Source Valve to gently flush the Snow Cone for about 10 sec
- Slide the Snow Bag over the Cone & secure it using the Ring-lok
- Fully open the Liquid CO₂ Source Valve to start a vigorous CO₂ flow & snow generation. During this step, shake & tap the sides of the Snow Cone / line & bags to prevent or break up any snow blockage. **Wear cryo-safety gloves during sampling.**



Sampling Liquid CO₂ with SnowQuik 1.3B
For NVR/NVOR



Final Product CO₂ “No-Haz” Sampling Kit SnowQuik 1.3B for NVR/NVOR & Sensory Tests

- When the Snow Bag is full (about 1 minute fill time), shut off the Liquid CO₂ Source Valve & allow the system to de-pressurize
- Immediately transfer the snow sample into a pre-weighed empty 1L NVR can until this can is filled between ½ to ¾ full. Obtain the filled can wt. (g), net snow wt. (g) and record on ID tag.
- Allow the snow to sublime before placing back into the pelican case for return shipment to Airborne Labs International



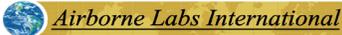
Sampling Liquid CO₂ with SnowQuik 1.3B
For NVR/NVOR



Return Samples to Airborne Labs International

- Airborne Labs International will deliver your report within 3 – 5 days after the receipt of your sample.





Carbon Dioxide (CO₂) Analysis
Coca-Cola® Beverage Grade Program

| | |
|--|---|
| <p>Customer Company: _____ Street Address 1: _____ City, State ZIP: _____ Phone: min-nnn-nnnn, Cell: min-nnn-nnnn, (Fac: min-nnn-nnnn) Attn: Mr./Ms./Dr. John Smith and Mr./Ms./Dr. Derek Jeter E-Mail: _____ Sample ID: Vaporized Liquid CO₂ Sample ID: Received in 2 x 2L Gas Sampling Bags + 2 MiniCyls + 1.0L NVR Can</p> | <p>ALI Track No.: _____ Received On: _____ Report Date: _____ Invoice No.: _____ Sample Date: _____ Sample Form: Vaporized Liquid CO₂ Process Stage: Final</p> |
|--|---|

| Test Description/Units: | Result | LOQ | Specification |
|--|--------|------|----------------------|
| CO ₂ Identification (% v/v by USP): _____ <small>Comments: All gas sampling bags tested & found to contain 99% CO₂.</small> | 99+ | 5 | report* |
| CO ₂ Purity (% v/v, ISBT 4.0): _____ <small>Comments: Obtained by NCG + target list impurity subtraction method.</small> | 99.99+ | 5 | 99.9 min |
| Moisture (H ₂ O, ppm v/v, ISBT 3.0): _____ | nd | 1 | 20 max |
| Oxygen (O ₂ , ppm v/v, ISBT 4.0): _____ <small>Comments: Result represents Total O₂ + Ar ppm v/v.</small> | nd | 1 | 30 max |
| Carbon Monoxide (CO, ppm v/v, ISBT 5.0): _____ | nd | 1 | 10 max |
| Ammonia (NH ₃ , ppm v/v, ISBT 6.0): _____ | nd | 0.5 | 2.5 max |
| Oxides of Nitrogen (NO _x , ppm v/v, ISBT 7.0): _____ | nd | 0.5 | report* |
| Nitric Oxide (NO, ppm v/v, ISBT 7.1): _____ | nd | 0.5 | 2.5 max |
| Nitrogen Dioxide (NO ₂ , ppm v/v, ISBT 7.1): _____ | nd | 0.5 | 2.5 max |
| Non-Volatile Residue (NVR, ppm v/v, ISBT 8.0): _____ <small>Comments: No NVR content was observed.</small> | nd | 2 | 10 max |
| Non-Volatile Organic Residue (NVOR, ppm v/v, ISBT 8.0): _____ <small>Comments: No NVOR content was observed.</small> | nd | 2 | 5 max |
| Methanol (MeOH, ppm v/v, ISBT 9.0): _____ | nd | 0.1 | 10 max |
| Total Volatile Hydrocarbons (THC, ppm v/v as CH ₄ , ISBT 10.0): _____ <small>Comments:</small> | nd | 0.1 | 50 max (20 as TNMHC) |
| Total Non-Methane Hydrocarbons (TNMHC, ppm v/v as CH ₄ , ISBT 10.1): _____ | nd | 0.1 | 20 max |
| Methane (CH ₄ , ppm v/v, ISBT 10.1): _____ | nd | 0.1 | report |
| Acetaldehyde (AA, ppm v/v, ISBT 11.0): _____ <small>Comments: No target BTEX impurities detected.</small> | nd | 0.05 | 0.2 max |
| Aromatic Hydrocarbon Content (ppb v/v as Benzene, ISBT 12.0): _____ <small>Comments: No target BTEX impurities detected.</small> | nd | 2 | 20 max |
| Total Sulfur Content (TSC, ppm v/v as S, ISBT 13.0): _____ | nd | 0.01 | 0.1 max |
| Hydrogen Sulfide (H ₂ S, ppm v/v, ISBT 14.0): _____ | nd | 0.01 | report |
| Carbonyl Sulfide (COS, ppm v/v, ISBT 14.0): _____ | nd | 0.01 | report |
| Dimethyl Sulfide (DMS, ppm v/v, ISBT 14.0): _____ | nd | 0.01 | report |
| Sulfur Dioxide (SO ₂ , ppm v/v, ISBT 14.0): _____ | nd | 0.02 | 1.0 max |

| Sensory Tests | | | |
|---|------|----|--------------------------|
| Odor & Appearance of Snow Test (Pass/Fail, ISBT 15.0): _____ <small>Comments: An ISBT 15.0 snow test requires a 5.5L cylinder sample.</small> | ..* | na | No foreign odor |
| Odor of Solid CO ₂ Residue (Pass/Fail): _____ <small>Comments: Sensory odor & visual residue tests performed on submitted 1L NVR can.</small> | pass | na | No foreign odor |
| Appearance of Solid CO ₂ Residue (Pass/Fail): _____ <small>Comments: Sensory odor & visual residue tests performed on submitted 1L NVR can.</small> | pass | na | No foreign appearance |
| Appearance in Water (Pass/Fail, ISBT 16.0): _____ | pass | na | No color or turbidity |
| Odor & Taste in Water (Pass/Fail, ISBT 16.0): _____ <small>Comments:</small> | pass | na | No foreign odor or taste |

Page 1 of 3

| | |
|-----------------------------|----------------|
| Sample ID: Customer Company | ALI Track No.: |
|-----------------------------|----------------|

| Source Specific Tests | Result | LOQ | Specification |
|---|--------|------|---------------|
| Hydrogen Cyanide (HCN, ppm v/v, ISBT SM 1.0): _____ | nd | 0.2 | nd |
| Vinyl Chloride (VCl, ppm v/v, ISBT SM 2.0): _____ | nd | 0.1 | nd |
| Phosphine (PH ₃ , ppm v/v, ISBT SM 3.0): _____ | nd | 0.25 | 0.3 max |

Comments:

| Speciated Volatile Hydrocarbons (VHG, ppm v/v by ISBT 10.1) | | | |
|---|----|-----|---------|
| Ethane: | nd | 0.1 | report* |
| Ethylene: | nd | 0.1 | report* |
| Propane: | nd | 0.1 | report* |
| Propylene: | nd | 0.1 | report* |
| Isobutane: | nd | 0.1 | report* |
| n-Butane: | nd | 0.1 | report* |
| Butene: | nd | 0.1 | report* |
| Isopentane: | nd | 0.1 | report* |
| n-Pentane: | nd | 0.1 | report* |
| Hexanes: | nd | 0.1 | report* |

Comments: PK ID based upon 1 match vs target analyte std. CH₄ result on pg. 1.

| Speciated Volatile Sulfur Compounds (VSC, ppm v/v by ISBT 14.0) | | | |
|---|----|------|---------|
| Carbon Disulfide: | nd | 0.01 | report* |
| Methyl Mercaptan: | nd | 0.01 | report* |
| Ethyl Mercaptan: | nd | 0.01 | report* |
| n-Butyl Mercaptan: | nd | 0.01 | report* |
| Isopropyl Mercaptan: | nd | 0.01 | report* |
| n-Propyl Mercaptan: | nd | 0.01 | report* |
| Methyl Ethyl Sulfide: | nd | 0.01 | report* |
| 2-Butyl Mercaptan: | nd | 0.01 | report* |
| i-Butyl Mercaptan: | nd | 0.01 | report* |
| Diethyl Sulfide: | nd | 0.01 | report* |
| n-Butyl Mercaptan: | nd | 0.01 | report* |
| Dimethyl Disulfide: | nd | 0.01 | report* |
| Unknown VSC: | nd | 0.01 | report* |

Comments: Peak ID based upon 1 match against target analyte standards. Note: TSC = most common sulfur agents reported on pg. 1.

| Speciated Volatile Oxygenates (VOX, ppm v/v, by ISBT 11.0) | | | |
|--|----|-----|---------|
| Dimethyl Ether: | nd | 0.1 | report* |
| Diethyl Ether: | nd | 0.1 | report* |
| Ethylene Oxide: | nd | 0.1 | report* |
| Propionaldehyde: | nd | 0.1 | report* |
| Acetone: | nd | 0.1 | report* |
| t-Butanol: | nd | 0.1 | report* |
| Ethanol: | nd | 0.1 | report* |
| Isopropanol: | nd | 0.1 | report* |
| Ethyl Acetate: | nd | 0.1 | report* |
| Methyl Ethyl Ketone: | nd | 0.1 | report* |
| 2-Butanol: | nd | 0.1 | report* |
| n-Propanol: | nd | 0.1 | report* |
| Isobutanol: | nd | 0.1 | report* |
| n-Butanol: | nd | 0.1 | report* |
| Isomyl Acetate: | nd | 0.1 | report* |
| Isomyl Alcohol: | nd | 0.1 | report* |
| Unknown VOX: | nd | 0.1 | report* |

Comments: Peak ID based upon 1 match against target analyte standards. AA = MeOH results reported on pg. 1.

LOQ = Limit of Quantitation (lowest amount of analyte quantitatively determined with suitable precision and accuracy). MDL = method detection limit (lowest amount of analyte detected), trace is unquantified amount observed between LOQ and MDL. nd = not detected (below MDL) = test not performed, na = not available, LT = less than the amount specified, OT = greater than the amount specified, % = percent, ppm = parts per million, ppb = parts per billion, report = value needed for Coca-Cola® supplier specification, report* = Additional values to the Coca-Cola® supplier requirement v/v = volume analyte/volume sample, w/w = weight analyte/weight sample, [ppb] indicates the result was obtained by the method listed within brackets, TSC = ISBT Total Sulfur Content excluding SO₂, Unit Conversion: 1 ppm v/v = 1 µL/L = 1000 ppb = 0.0001% v/v, Date Rec'd: MM/DD/YYYY.

Report Summary:
Customer requested a standard Coca-Cola® beverage grade LOQ, test program.
This sample meets all Coca-Cola® purity guidelines for beverage grade LOQ.

Reviewed by / Date:
Jeff Wahome 01/01/2020
Jeff Wahome - Analytical Operations Manager




Accreditation # 68090

Attachments: none
AliForm: Signature, Instrument & Notebook data on file
ISO Statement
Statements of conformity (pass or fail) resulting from the test/analysis performed on the above sample will not take into account the reported measurement uncertainty unless otherwise specified. This is a shared risk decision rule in which the customer also has responsibility for determining acceptance of the results. The methods Airborne Labs International uses are developed by Airborne Labs International and are based on the current revisions of international, national, or industry standards unless otherwise specified. Methods can be reviewed by the customer upon request. The acceptance criteria of the above items are based on ISBT specifications, NFPA, CGA, USP, or other industry specifications unless otherwise specified on the contract.

Page 2 of 3

The Airborne Advantage

- Airborne not only provides the rental equipment or purchased equipment needed to take your sample, but we also provide Trouble Shooting and Advice.
- NOTE: while CO2 Final Product was presented, Airborne Labs International also provides:
 - CO₂ Feed Gas
 - N₂ testing (Beverage, UHP and Industrial)
 - LIN, LOX, LAR
 - Hydrogen Fuel Cell
 - SF₆
 - And more



| If your value is high | Check | Prevent Occurrences |
|--|--|--|
| Purity (low) | MEA solution | Monitor MEA |
| | KMnO4 solution | Monitor KmnO4 |
| | Carbon Filters | Monitor Burner conditions |
| Moisture | Dryer Regeneration | Verify regeneration cycle |
| | Compressors Overloaded | Check compressor operation |
| | Purge moisture traps | Empty |
| Oxygen | Excess air in combustion | Verify burner operating parameters |
| | Improper sampling | Verify proper sampling procedure |
| Ammonia | MEA carry over | Check the temperature, flow and concentration |
| | Refrigeration system leak | |
| | Fuel | |
| Nitric Oxide and Nitrogen Dioxide | Excess air in combustion | Monitor Combustion |
| | Operation cooler | Fresh water, verify flow & pressure, Check Ph of water |
| Non-Volatile Residue | Oil carry over, Oil traps, compressor | Monitor carbon, alumina & combustion |
| | Carbon carry over | |
| | Alumina carry over | |
| | Combustion soot (extremely fine) | |
| Total Hydrocarbon (as Methane) | Carbon in Purification System | Monitor Purification System (carbon) and Combustion |
| | Combustion too rich | |
| Acetaldehyde | Combustion rich in Air | Verify combustion |
| | MEA & KMnO4 carry over | Monitor MEA Concentration |
| Aromatic Hydrocarbon | Fuel quality | Check the source or change of fuel |
| | Carbon filters | |
| | Incomplete Combustion | |
| Carbon Monoxide | Combustion too rich in fuel | Verify combustion |
| | MEA concentration low (foaming) | Verify MEA concentration and flow |
| | Low MEA level | Verify MEA |
| | KMnO4 solution too weak or exhausted | Verify KMnO4 |
| Total Sulfur (as S) | Fuel | Monitor Combustion & KMnO4 |
| | Cooler | |
| | Combustion Rich in fuel | |
| Carbonyl Sulfide | KMnO4 concentration | Monitor Combustion & KMnO4 |
| | Incomplete Combustion | |
| | Fuel quality | |
| | KMnO4 concentration (too weak) | |
| Hydrogen Sulfide | Incomplete Combustion | Monitor Combustion & KMnO4 |
| | Fuel quality | |
| | KMnO4 concentration (too weak) | |
| Sulfur Dioxide | Water cooler | Monitor Cooler and Soda Ash |
| | Soda Ash concentration | |
| | MEA solution | |
| | Fuel quality | |
| Odor | Carbon heavy sulfur, ammonia & organic compounds | |
| KMnO4 = Potassium permanganate | | |

1L and 5.9L Liquid CO₂ Sampling

Airborne Labs International offers the SPC-1L (Silconert Passivated Cylinder) and the 5.9L Aluminum cylinder to properly sample and ship Liquid phase Carbon Dioxide

To properly ship this Liquid CO₂ sample, you must be certified in an appropriate IATA Hazardous Material Training Course or your local Hazardous Material Training Course for Ground Transportation

FINAL PRODUCT
1L SAMPLING KIT



FINAL PRODUCT
5.9L SAMPLING KIT



Hazardous Shipment

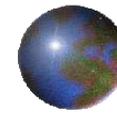


Liquid Sampling Cylinders SPC-1L

- Silconert Passivated Cylinder 1L (SPC-1L) with Dip Tube (educator tube) prevent “wall-adsorption” effects that can be experienced with volatile sulfur compounds and other trace CO₂ impurities
- Proper sampling techniques will allow for the collection of 450 – 600g of liquid CO₂



YouTube
Training
Video

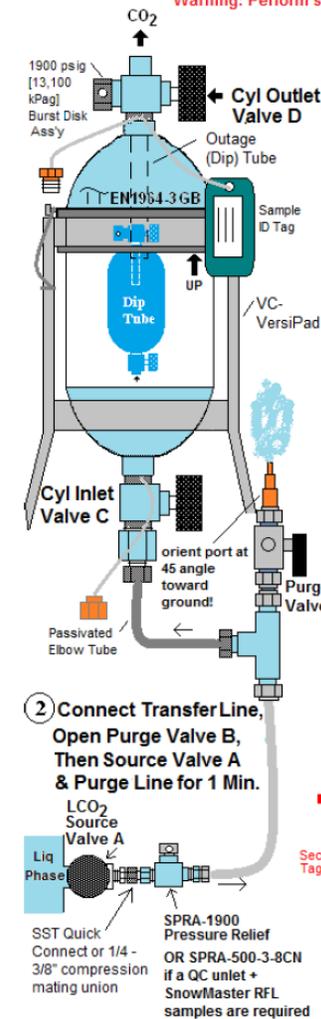


Airborne Labs International, Inc.

22C World's Fair Drive, Somerset, NJ 08873 Tel: 732-302-1950 Fax: 732-302-3035
E-Mail: airborne@alabs.com Website: www.airbornelabs.com

SPC-1L LCO₂ Sampling / Hazmat Shipping

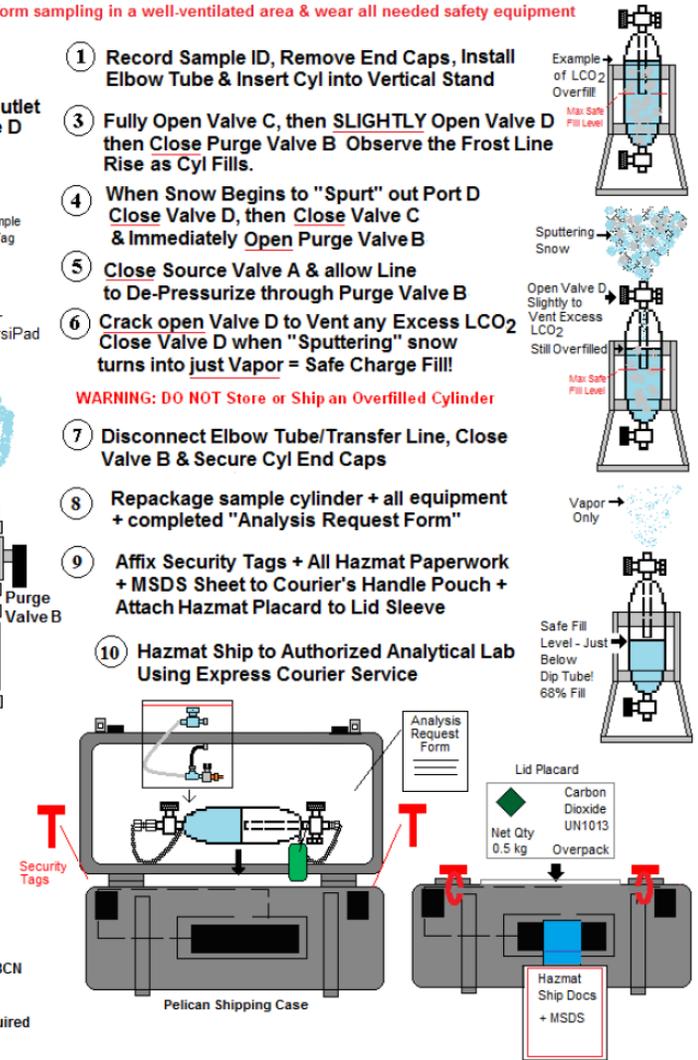
Warning: Perform sampling in a well-ventilated area & wear all needed safety equipment



2 Connect Transfer Line, Open Purge Valve B, Then Source Valve A & Purge Line for 1 Min.

- 1 Record Sample ID, Remove End Caps, Install Elbow Tube & Insert Cyl into Vertical Stand
- 3 Fully Open Valve C, then SLIGHTLY Open Valve D then Close Purge Valve B Observe the Frost Line Rise as Cyl Fills.
- 4 When Snow Begins to "Spurt" out Port D Close Valve D, then Close Valve C & Immediately Open Purge Valve B
- 5 Close Source Valve A & allow Line to De-Pressurize through Purge Valve B
- 6 Crack open Valve D to Vent any Excess LCO₂ Close Valve D when "Sputtering" snow turns into just Vapor = Safe Charge Fill!
- 7 Disconnect Elbow Tube/Transfer Line, Close Valve B & Secure Cyl End Caps
- 8 Repackage sample cylinder + all equipment + completed "Analysis Request Form"
- 9 Affix Security Tags + All Hazmat Paperwork + MSDS Sheet to Courier's Handle Pouch + Attach Hazmat Placard to Lid Sleeve
- 10 Hazmat Ship to Authorized Analytical Lab Using Express Courier Service

WARNING: DO NOT Store or Ship an Overfilled Cylinder



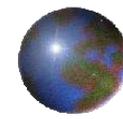
Liquid Sampling Cylinders

5.9L

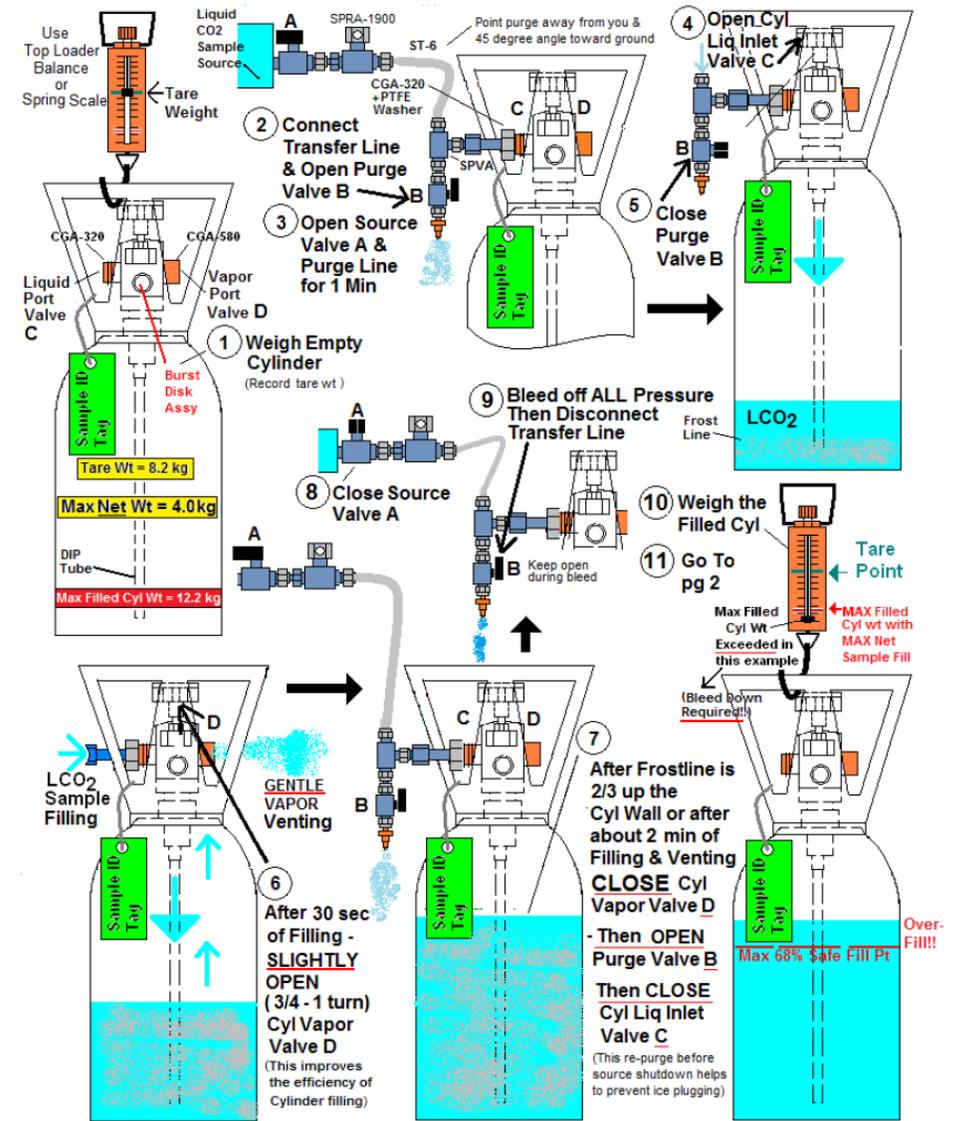
- The 5.9L aluminum cylinder has a dual head valve allowing for liquid CO₂ filling into the CGA-320 port with Dip Tube (educator tube) while allowing headspace gas to be vented during the filling process from the CGA-580 port
- Proper sampling techniques will allow for the collection of 4000g or 4kg of liquid CO₂



YouTube
Training
Video



Airborne Labs International, Inc.



Liquid Sampling Cylinders & Analytical Systems

- The big advantage to a Liquid CO₂ fill cylinder is the amount of gas that can be produced as the sample is vaporized.
- The 1L cylinder and the 5.9L cylinder have enough capacity to conduct a complete analysis on the below Analytical Systems:



Xcela Series Analyzer Systems
Available in Baseline or Teledyne configurations & modular to fit your budget

MAX-Bev with Atlas Truck Station
Full ISBT list in 11 minutes including Purity

Summary

Airborne Labs International, Inc

Your Analytical Partner

- CO2 Programs
 - Feed Gas
 - Final Product
 - Rental Kits, Purchased Kits, Customer Owned Kits
- Analytical Systems (small to large)
 - With Airborne Laboratory Backup
- Onsite Sampling and Training Programs
- Other Analytical Programs & Trouble Shooting
 - Industrial Commodity Gases
 - ABO
 - Air Analysis
 - SF6 Test Programs
 - Specialized Gases
 - Hydrogen Fuel Quality
 - Gas Distribution Systems
 - R&D Project Support



Thank You

Authors

- Mark R. Taylor, President
 - Mark.Taylor@airbornelabs.com
- Don Pachuta, Ph.D., CEO
 - Don.Pachuta@airbornelabs.com
- Chandler Stryker, Technical Sales
 - Chandler.Stryker@airbornelabs.com



Airborne World-Wide Offices & Distributors

- Angola
- Brazil
- China
- France
- India
- Israel
- Pakistan
- Poland
- Philippines
- Russia
- United Arab Emirates
- United States of America
- South Africa
- Thailand
- Taiwan

