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DAQ-03-006.2 Standard Operating Procedure (SOP)
Entech 4700 Precision Diluter
OPERATOR RESPONSIBILITIES

Revision 0

1.0 Approval Sign Off-Sheet

I certify that I have read and approve of the contents of the Entech 4700 Precision Diluter Standard Operating Procedure with an effective date of April 1st, 2021.

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Disclaimer: This document, and any revision hereto, is intended solely as a reference guide to assist individuals in the operation of the instrument, related to the North Carolina Division of Air Quality's Ambient Monitoring Program.

SOP Acronym Glossary

ADQ - Audit of data quality

AQS - Air Quality System (EPA's Air database)

°C – degrees Celsius

CFR – Code of Federal Regulations

CGA – Compressed Gasses Association

Chief – Ambient Monitoring Section chief

COA – Certificate of Analysis

COC – Chain of custody

COM – Communication Port

DAQ - North Carolina Division of Air Quality

DAS – Data acquisition system

DEQ – North Carolina Department of Environmental Quality

DI – deionized water

Director – Division of Air Quality Director

ECB – Electronics and Calibration Branch

e-log – electronic logbook

EPA – United States Environmental Protection Agency

FEM – Federal equivalent method

FRM – Federal reference method

HPLC – High Performance Liquid Chromatography

in - inches

L – liters

LAB – Laboratory Analysis Branch – DAQ Lab located at 4403 Reedy Creek Rd in Raleigh, NC

LED – Light emitting diode

mbar – millibar

MDL – Method detection limit

mL - milliliter

NC – North Carolina

NIST – National institute of standards and technology

PAMS – Photochemical assessment monitoring station

PC – Personal computer

PDF – portable document format

PM – Particulate matter

PPB – Projects and Procedures Branch

ppb - parts per billion

PPE – Personal Protective Equipment

ppm – parts per million

psi – pounds per square inch

psi_A – pounds per square inch – absolute scale

PSIA – pounds per square inch – absolute scale

QA – Quality assurance

QA/QC - Quality assurance/quality control

QAPP - Quality assurance project plan

QC – Quality control

RCO – Raleigh central office

RPM – Revolutions per minute

SOP – Standard operating procedure

TSA – Technical systems audit

UAT – Urban Air Toxics

USB – Universal Serial Bus

μL – microliter

VOC – Volatile organic compound

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2.0 SCOPE AND PURPOSE

The scope and purpose of this SOP is to describe the steps required to successfully operate the Entech 4700 Precision Diluter employed to create analytical gas-phase standards, QC samples and humidified blanks in 6-L treated Summa canisters for LAB instrumentation in support of UAT and PAMS monitoring. The Entech 4700 Precision Diluter includes proprietary high resolution pressure monitoring circuitry that measures and records every step of an automated dilution process, allowing for sub-ppm level dilutions from ppm level standards with high accuracy and precision.



Figure 1: Entech 4700 Precision Diluter



Figure 2: Entech Silonite Silco-Treated Summa 6L Canister



Figure 3: Restek Silco-Treated SilcoCan 6L Canister

3.0 EQUIPMENT CHECKS AND MATERIALS

This section describes the equipment and materials that are required to complete the steps described in this document. Additional subsection(s) or SOPs will also describe the equipment and materials as needed.

3.1 Equipment and Material List

- Entech 4700 Precision Diluter
- Computer and monitor with Windows 10 operating system installed with:
 - Entech 4700 Precision Diluter System software (v2.1.2.13 or later)
 - Adobe PDF Reader
 - Microsoft Office 365 Suite
 - USB mouse and keyboard
- Certified clean 6-L Silco-treated summa canisters or equivalent
 - Certification and cleaning process detailed in **SOP DAQ-03-005.2 Entech 3100A Canister Cleaner**.
 - Example Canisters shown in Figures 2 and 3.
- Entech 4700 Precision Diluter Standard Preparation Binder
- Entech 4700 Precision Diluter Standard Preparation Logbook
- Ultra Zero Air (Arc3 Gases Grade 0.1 or equivalent – See Appendix A for Purity Information)
- Ultra High Purity Helium (Arc3 Gasses Grade 5 or equivalent)
- Analytical Gas Standards (NIST-traceable, custom VOC blend)
- CGA590 Regulator
- CGA580 Regulator
- CGA350 Regulators (for custom VOC blend standards, one per standard)
- Cylinder Transportation Cart
- Deionized water (HPLC Grade, Submicron filtered or equivalent)
- Clean 30-mL Beaker
- 100- μ L Hamilton gas-tight glass syringe or equivalent
- 2 x ¼-in compression fitting male nut caps, stainless steel
- ¼-in compression fitting female nut cap, brass or stainless steel
- Hand Tools:
 - 9/16-in wrench
 - ½-in wrench
 - 7/16-in wrench
 - 12-in adjustable wrench or larger (for gas cylinder changes)
 - ¼-in Die
 - Phillips-head Screwdriver
 - Dremel Tool, Accessories and Workstation
 - Scissors
- PPE:
 - Gloves:
 - Nitrile
 - Textured grip, heat resistant work gloves
 - Non-slip steel toed shoes or boots

- Safety glasses: prescription or impact resistant are acceptable
- 1/8-in Silonite tubing (to connect canisters and standards) and fittings
- NIST-Traceable Barometer Fisher Scientific Traceable® or equivalent
- Agilent G3388B Electronic Leak Detector or equivalent
- 2A replacement fuse

3.2 Chemical and Material Checks

All standards used in the precision diluter must be valid, non-expired, NIST-traceable VOC blends. Standards can be recertified by the vendor in lieu of buying a new standard as long as sufficient pressure remains. COAs and standard reference materials must be maintained by the operator with diligence as shown in appendix B. Standards are certified for a period determined by the vendor based on a specific VOC blend stability. Copies of the current cylinder inventory certificates of analyses must be stored in the back of the Entech 4700 Precision Diluter Standard Preparation Binder.

3.3 Support Equipment Checks

3.3.1 Ultra Zero Air Cylinder Check

- 1 Open the ultra-zero air cylinder and read the regulator pressure. The outlet pressure should be set to 50 psi.
- 2 If cylinder pressure is below 100 psi or the cylinder is expired, change the cylinder by closing the cylinder and loosening the regulator with an adjustable wrench. **Note:** CGA590 cylinders are reversed threaded.
- 3 Place the regulator on the bench and replace the cylinder. Be sure to use a cylinder cart to transport cylinders safely.
- 4 Reinstall the regulator by tightening the nut and open the cylinder. The pressure will read about 2400 psi.
- 5 Record the lot and expiration date of the ultra-zero air cylinder in the Entech 4700 Software configuration file as detailed in steps 6 and 7 of section 5.1.
- 6 Close the ultra-zero cylinder and regulator after Entech 4700 Precision Diluter operation is complete.

3.3.2 Analytical Gas Standard Cylinder Check

- 1 Open the standard cylinder of interest and read the regulator pressure. The outlet pressure should be set to 40 psi.
- 2 If the regulator pressure gauge for the cylinder reads below 100 psi, then change to a new standard cylinder by closing the current cylinder and loosening the regulator with an adjustable wrench. If the standard has sufficient pressure remaining (< 500 psi) and is approaching the expiration date, contact the manufacturer for recertification of the analytical standard. **Note:** CGA350 cylinders are reversed threaded.
- 3 Place the regulator on the bench and replace the cylinder. Be sure to use a cylinder cart to transport cylinders safely.
- 4 Reinstall the regulator by tightening the nut and open the cylinder.
- 5 Record the name, lot and expiration date of the standard cylinder in the 4700 Software configuration file as detailed in steps 6 and 7 of section 5.1.
- 6 Close the standard cylinder and regulator after Entech 4700 Precision Diluter operation is complete.

3.3.3 4700 Precision Diluter Pressure Sensor Check

- 1 Remove the ¼-in nut from the outlet port on the front of the diluter and allow the pressure to equilibrate to ambient conditions for 30 seconds.

- Compare the NIST-traceable local barometric pressure to “Current PSIA” reading in the top left corner of the 4700 Precision Diluter Software.
- The Fisher Traceable® NIST-Traceable Barometer reads units of mbar and must be converted to psi_A and the conversion can be done with the following equation:

$$(1) \text{psi}_A = (\text{Ambient Pressure}_{\text{mbar}}) \left(\frac{14.50377 \text{psi}_A}{1 \text{bar}} \right) \left(\frac{1 \text{bar}}{1000 \text{mbar}} \right)$$

Report the result with the correct number of significant digits.

- If the reading is within ± 0.1 psi_A of ambient pressure, it is okay to proceed with a dilution. Record this check in the Entech 4700 Precision Diluter logbook.
- If the reading is out of specifications, see section 9.4 for corrective action.

4.0 SITE CHECKS

This section is reserved. Site checks do not apply to instruments housed at the Reedy Creek Laboratory.

5.0 DETAILED PROCEDURES

5.1 System Start Up and Preparation

- Boot, if required, and login to the precision diluter system computer.
- Press the power button on the Entech 4700 Precision Diluter, located in the bottom left corner. The power LED will illuminate on the front panel.
- Double click the Entech 4700 icon on the desktop to connect to the precision diluter.
- The link active LED on the 4700 front panel will illuminate once connected. See section 9.1 for communications troubleshooting. The following software screen will appear on the computer:

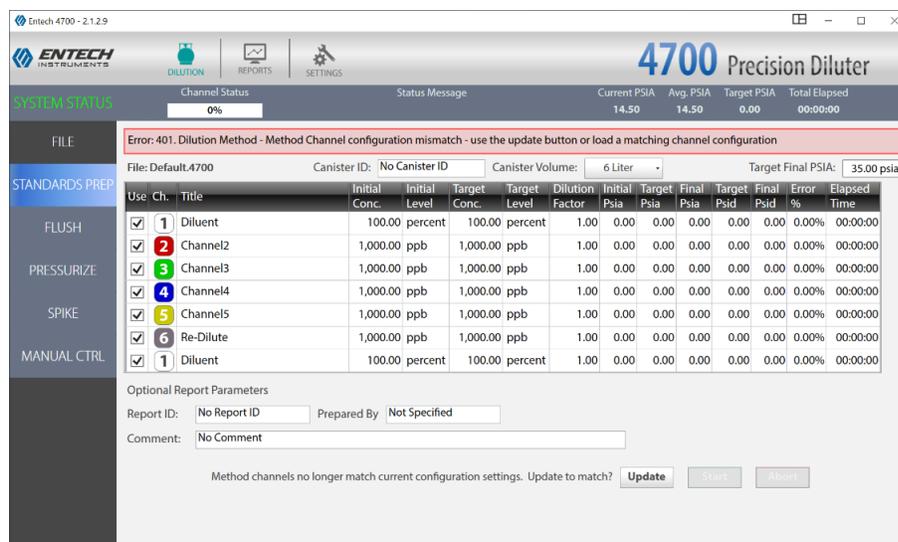


Figure 4: Entech 4700 Precision Diluter Software Initial Boot

- The “Error 401. Dilution Method” will trigger at each launch of the software due to multiple user profiles. Click the update button to load the configuration file. The screen will now populate with the cylinder inventory equipped to the precision diluter:

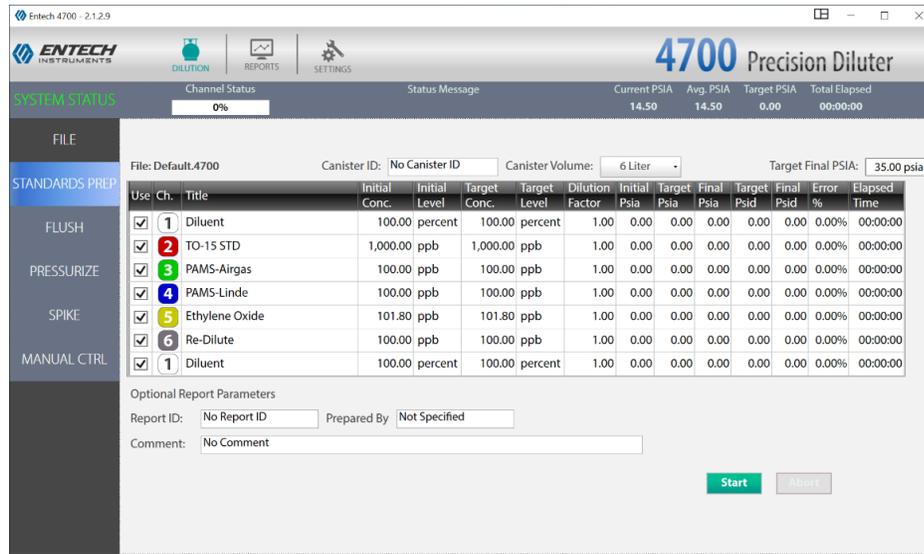


Figure 5: Entech 4700 Precision Diluter Software with Configuration File Loaded

- 6 Confirm that the cylinder information is correct, in the event it needs to be updated, navigate to the “settings” gear and wrench icon on the top menu of the software. Next, select the “configuration” tab as shown below. The current configuration and cylinder inventory will appear:

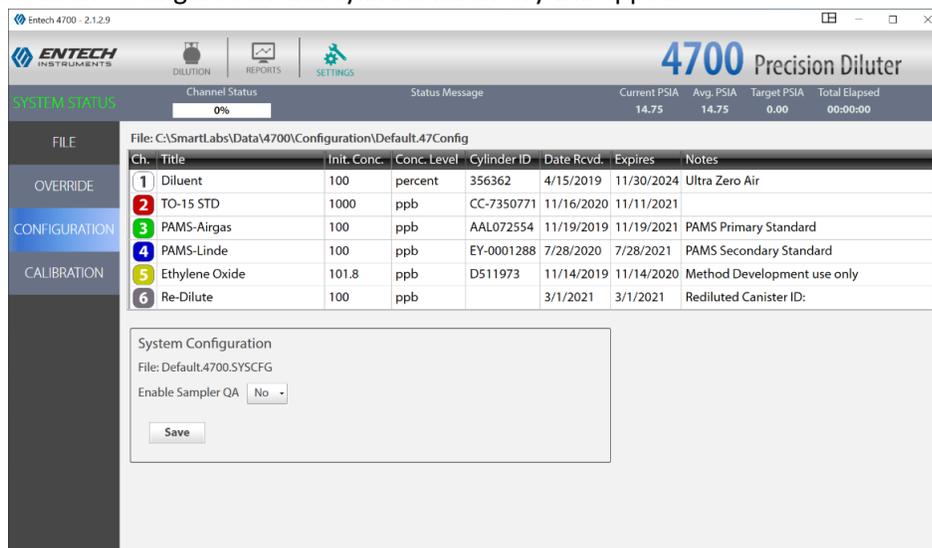


Figure 6: Entech 4700 Precision Diluter Software with Configuration File Loaded

- 7 Enter in the cylinder lot ID, receive date, expiration date for each channel, 2-5, connected to the Precision Diluter. Click on the file tab of the left hand menu and select “save configuration.” Overwrite the existing configuration file.
- 8 Open the regulator to the ultra-zero air supply cylinder and confirm the outlet pressure is set to 50 psi.
- 9 Open the regulator on the analytical gas standard cylinder of interest; confirm the outlet pressure is set to 40 psi.
- 10 Remove the ¼-in cap nut from the outlet stream on the front of the diluter. In the left hand menu of the Entech 4700 Precision Diluter software click the flush tab. The following screen will appear:

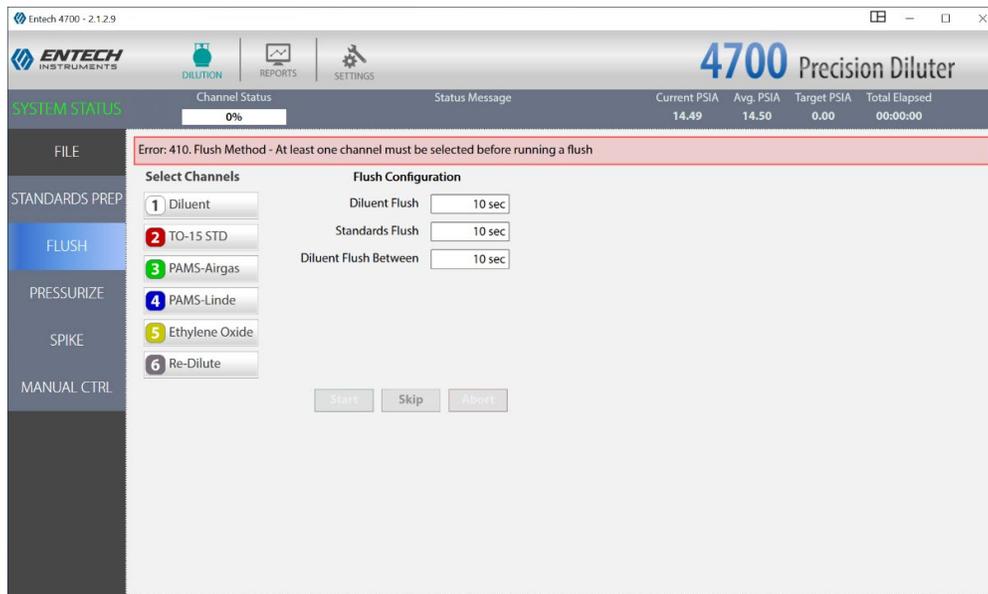


Figure 7: Entech 4700 Precision Diluter Software Flush Home Screen

- 11 Select the diluent channel (number 1) and the analytical standard(s) of interest. If more than one standard will be used in a given diluter session, then select all that apply. Apply a “Diluent Flush” of 30 seconds, a “Standard Flush” of 30 seconds, and a “Diluent Flush Between” of 30 seconds. A PAMS system flush is demonstrated below:

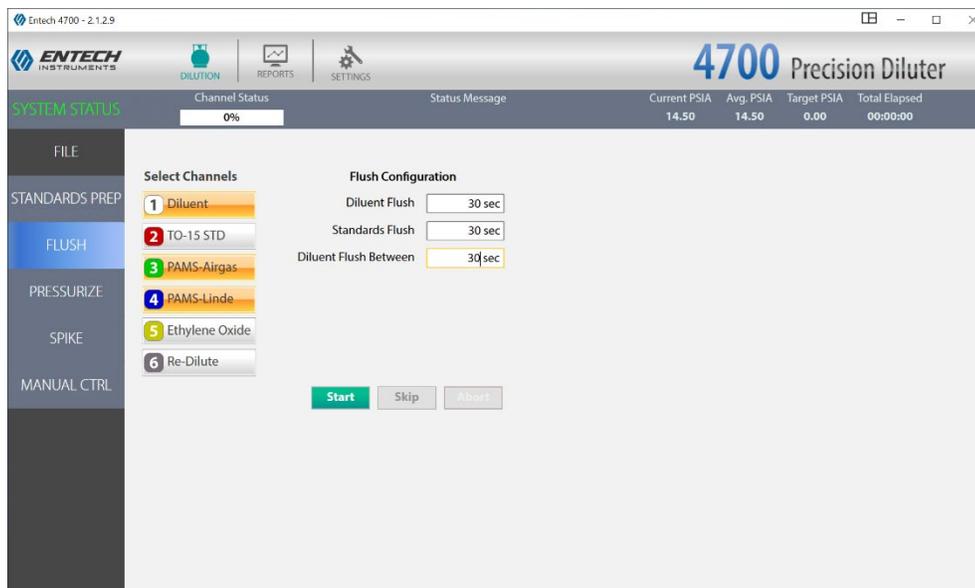


Figure 8: Entech 4700 Precision Diluter Software Flush PAMS Example

- 12 Press start to begin the flush and wait for it to complete. The channel status bar will show the progression of the flush as the system purges each line.
- 13 Prepare an aliquot of deionized water in a clean 30-mL beaker. Dispense about 5 mL of water.
- 14 Using a clean 100- μ L gas-tight syringe, flush the syringe with the deionized water three times. Be sure to examine the barrel of the syringe for any air bubbles and repeat flushing the syringe until all air is displaced with water.
- 15 The operator can now proceed to the system leak check in Section 5.3.

5.2 Creating Dilution Methods

- 1 Select “Standards Prep” from the left hand menu in the 4700 Diluter software. Click file and select “New Method.”
- 2 Channel 1, the diluent, must be selected both times. The system operates by filling a canister with diluent gas to a specified pressure, then a specified pressure interval of standard gas, and finally tops off the dilution canister to the final target pressure with diluent gas. Uncheck the “use” box column for standards in the inventory that are not of interest for the targeted dilution.
- 3 Enter a target final pressure in psi_A in the top right corner of the window. The maximum pressure for a dilution is 50 psi_A.
- 4 In the “Target Conc.” column, enter the concentration of the dilution desired or enter the dilution factor of the standard in the dilution factor column (each column will populate the other with the correct value based on the value entered). A maximum dilution factor of 100 can be achieved with the Entech 4700 Precision Dilution System. Further dilutions require a serial dilution of an already prepared standard and are detailed in section 5.4.3. An example dilution, creating a 2 ppb standard from an 100 ppb PAMS-Airgas standard, is shown below:

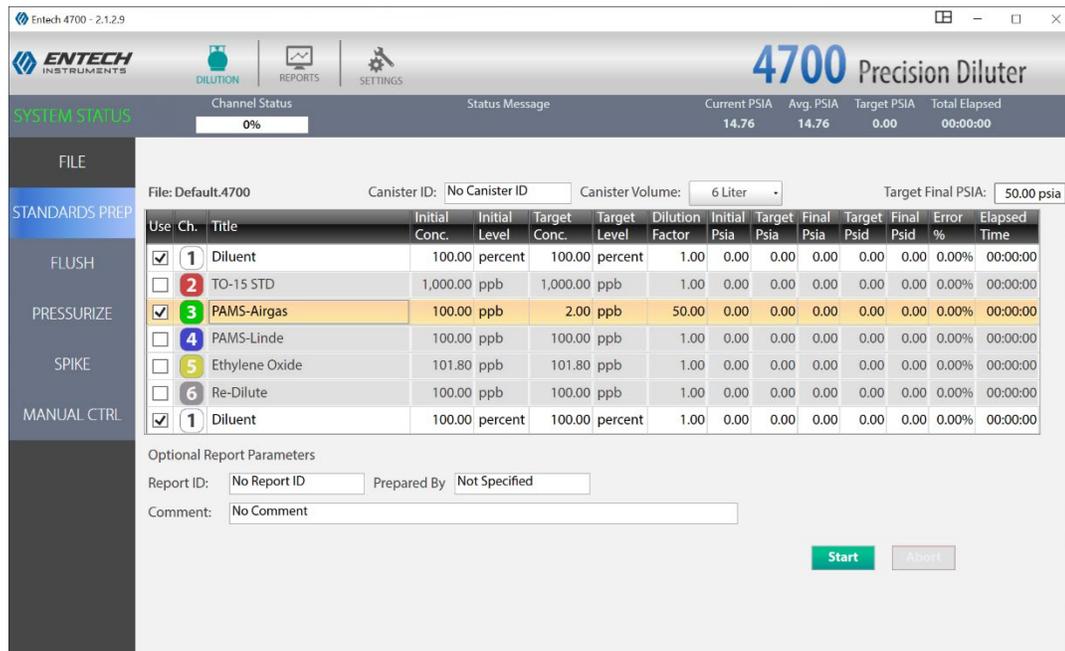


Figure 9: Entech 4700 Precision Diluter Software 2 ppb PAMS Preparation Example

- 5 Click file and select “Save Method.” Use a name that details the concentration of the standard created and the source from which it came. E.g. The standard in Figure 9 could be saved as 2ppb_PAMS-Airgas.

5.3 System Leak Check

- 1 In the Entech 4700 software navigate back to the “Standards Prep” tab in the left-hand menu.
- 2 Select a clean and evacuated standard canister for standard preparation. In the Precision Diluter Logbook document the date, operator initials, standard canister number (**Note:** standard canisters and ambient sample canister numbers follow separate naming conventions. Standard canisters are denoted with an S preceding the canister serial number. Ambient canisters are not to be used for standard preparation.), the cleaning batch number of the canister (located on the canister tag – see appendix C for an example tag), diluent

cylinder lot, analytical gas standard cylinder number and DI water lot number. A template logbook entry sheet for the Entech 4700 Precision Diluter is shown in appendix D.

- 3 Dispense a 75- μ L aliquot of deionized water into the orifice of the standard canister.
- 4 Connect the standard canister to the outlet port with a 9/16-in wrench. Take care not to over tighten the canister connection, a quarter-turn past finger tight is a best practice for compression fittings.
- 5 Open the valve and observe the pressure read back of the system in the top left of the screen under “Current PSIA.” It will drop from an ambient reading to near zero on the absolute scale.
- 6 Observe the pressure read back for 30 seconds and look for stability in the measurement. Reject canisters that the observed pressure increases by more than 0.5 psi_A over 30 seconds. See section 9.2 for corrective action.
- 7 The canister is ready to proceed through the desired preparation process; See section 5.4.1 for Analytical Standard Preparation, section 5.4.2 for Humid Blank Preparation or 5.4.3 Serial Dilution of a Prepared Standard.

5.4 Precision Diluter Operation: Standard Preparation

Select the desired subsection based on the operator objective:

5.4.1 Preparation of an Analytical Gas Standard

- 1 Click on the “File” tab of the left hand menu and select “Load Method.” Select the desired canister preparation method. Record the method loaded and executed for a dilution in the Entech Precision Diluter logbook. An example dilution method is shown below in Figure 10:

Entech 4700 - 2.1.2.9

ENTECH INSTRUMENTS

DILUTION REPORTS SETTINGS

4700 Precision Diluter

Channel Status: 0% Status Message: Current PSIA: 14.49 Avg. PSIA: 14.49 Target PSIA: 0.00 Total Elapsed: 00:00:00

FILE

STANDARDS PREP

FLUSH

PRESSURIZE

SPIKE

MANUAL CTRL

File: PAMS\2ppbvPAMS_Airgas.4700 Canister ID: No Canister ID Canister Volume: 6 Liter Target Final PSIA: 50.00 psia

Use	Ch.	Title	Initial Conc.	Initial Level	Target Conc.	Target Level	Dilution Factor	Initial Psia	Target Psia	Final Psia	Target Psid	Final Psid	Error %	Elapsed Time
<input checked="" type="checkbox"/>	1	Diluent	100.00 percent		100.00 percent		1.00	0.00	0.00	0.00	0.00	0.00	0.00%	00:00:00
<input type="checkbox"/>	2	TO-15 STD	1,000.00 ppb		1,000.00 ppb		1.00	0.00	0.00	0.00	0.00	0.00	0.00%	00:00:00
<input checked="" type="checkbox"/>	3	PAMS-Airgas	100.00 ppb		2.00 ppb		50.00	0.00	0.00	0.00	0.00	0.00	0.00%	00:00:00
<input type="checkbox"/>	4	PAMS-Linde	100.00 ppb		100.00 ppb		1.00	0.00	0.00	0.00	0.00	0.00	0.00%	00:00:00
<input type="checkbox"/>	5	Ethylene Oxide	101.80 ppb		101.80 ppb		1.00	0.00	0.00	0.00	0.00	0.00	0.00%	00:00:00
<input type="checkbox"/>	6	Re-Dilute	100.00 ppb		100.00 ppb		1.00	0.00	0.00	0.00	0.00	0.00	0.00%	00:00:00
<input checked="" type="checkbox"/>	1	Diluent	100.00 percent		100.00 percent		1.00	0.00	0.00	0.00	0.00	0.00	0.00%	00:00:00

Optional Report Parameters

Report ID: No Report ID Prepared By: Not Specified

Comment: No Comment

Start About

Figure 10: Entech 4700 Precision Diluter with Preparation Method Loaded

- 2 Fill in the “Canister ID” field with the canister number (format: S#####), delete/empty the Report ID field, put the operator initials in the prepared by field, and put the 75- μ L aliquot of DI water into the comment field with the lot number. An example for canister S2403 is shown in Figure 11:

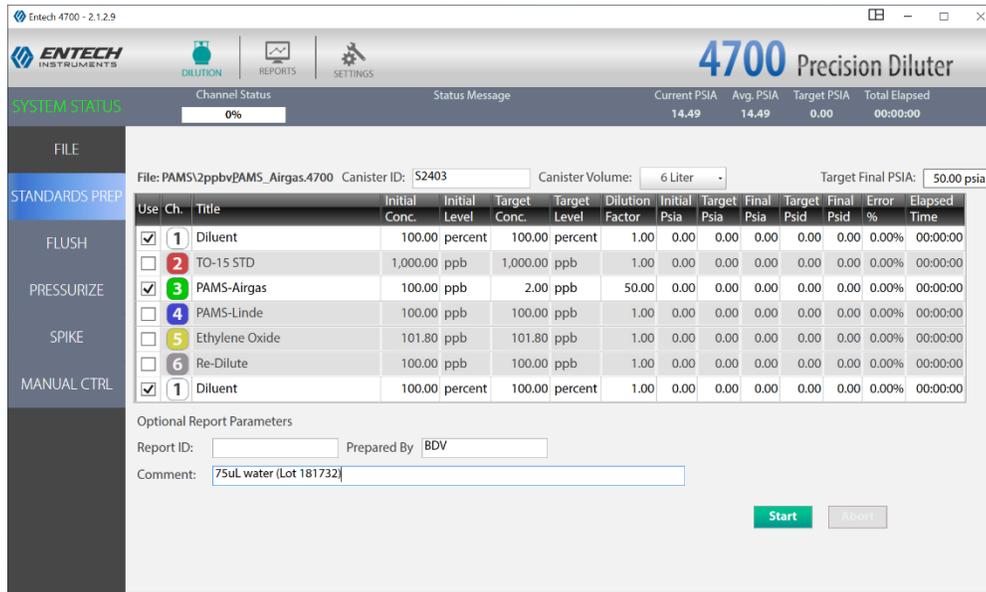


Figure 11: Entech 4700 Precision Diluter Preparation Example for Canister S2403

- 3 Press start to begin the standard preparation. The system will initially fill the canister with diluent gas, then standard gas, and finish with diluent gas. A report will generate when complete. Standard preparation times vary depending on concentration and final pressure and can take 20-40 minutes to complete depending on the parameters selected.
- 4 Close the canister valve and disconnect the canister with the 9/16-in wrench.
- 5 Click the report tab on the top row of the Entech 4700 Precision Diluter software. The screen will populate with a dilution report for the newly created standard. Click the floppy disk icon and save the report as a PDF. Name the report in the following format: YYMMDD Standard Name Concentration Canister Number. For the canister previously prepared on October 1st, 2020 at 2 ppbv of PAMS-Airgas the report would be saved as 201001 PAMS-Airgas 2ppb CanS2403. Save the report in the report folder. An example report is shown below in Figure 12:

4700 Precision Diluter Standards Preparation Report

Date: 10/1/2020 2:09:22 PM

Dilution ID: 207

Report ID:

Canister Size: 6000cc

Canister ID: S2391

Target Final Psia: 50

Prepared By: BDV

Comment: 75uL Water Lot (181732)

Channel Methods

Ch.	Title	Init. Conc.	Target Conc.	Dilution Factor	Init. Psia	Target Psid	Final Psid	Target Psia	Final Psia	Duration	Final Conc.
1	Diluent	100 percent	100 percent	1	0.13	11.84	11.84	11.98	11.98	00:06:48	N/A
3	PAMS - Airgas	100 ppb	2 ppb	50	11.98	1.00	1.00	12.98	12.98	00:01:48	2.01 ppb
1	Diluent	100 percent	100 percent	1	12.98	37.02	37.02	50.00	50.00	00:23:16	N/A

Total Duration: 00:32:00

Channel Configuration and Standards Inventory

Ch.	Source	Init. Conc.	Cylinder ID	Expiration Date	Notes
1	Diluent	100 percent	356362	11/30/2024	Zero Air
3	PAMS - Airgas	100 ppb	AAL072554	11/19/2021	

Figure 12: Entech 4700 Precision Diluter Standards Preparation Report

- 6 Print a copy of the 4700 Precision Diluter Standards Preparation Report and place it in the Entech 4700 Precision Diluter Binder. Initial and date the copy after reviewing it for accuracy. Cross out any errant entry with a line and write the correct value next to it. Initial and date.
- 7 Label the canister tag with the standard name. E.g. "PAMS-Airgas 2ppb" and the preparation date.
- 8 Return to the flush menu and flush the system with diluent only for 30 seconds to purge the system.
- 9 Close all analytical gas standards and ultra-zero air cylinders and corresponding regulators.
- 10 Cap the canister standard with a ¼-in female compression nut. A best practice is to let the prepared standard sit over-night prior to use to allow the water to interact with the canister and introduced compounds to ascertain equilibrium.
- 11 Cap the Entech 4700 Precision Diluter with ¼-in male compression nuts to finger tight.
- 12 Cap the newly created standard with a ¼-in female compression nut.

5.4.2 Preparation of a Humidified Blank

- 1 Click on the "Pressurize" tab of the left hand menu. "Error 420. Pressure Method – Select a container type to continue" will appear on the screen:

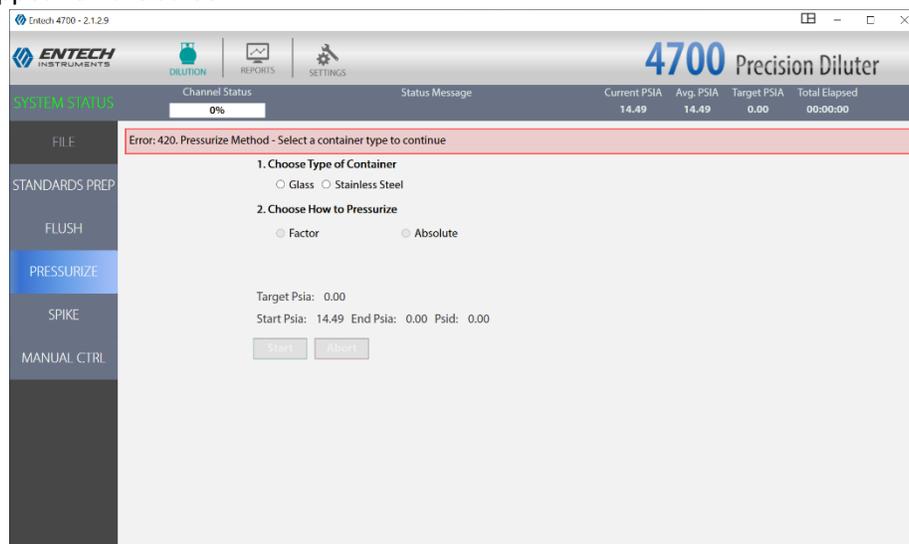


Figure 13: Entech 4700 Precision Diluter Pressurize Tab

- 2 Select the stainless steel container type by clicking the radio button.
- 3 Select the absolute pressurize function in step 2 "chosed how to pressurize." Enter 50 in the psia box that appears as shown below in Figure 14:

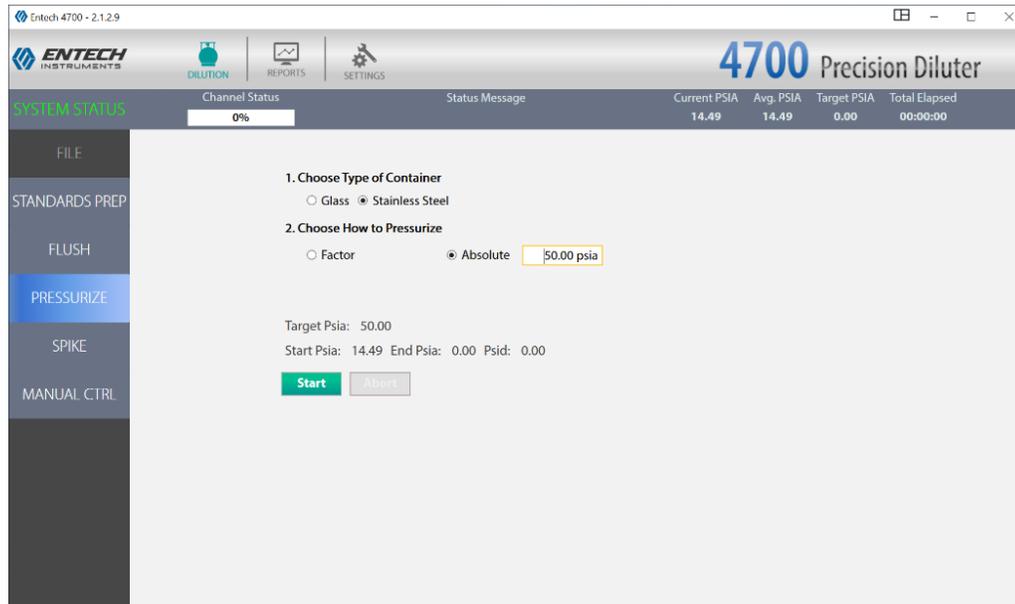


Figure 14: Entech 4700 Precision Diluter Pressurization Settings

- 4 Click start and wait until the system is finished pressurizing the canister with ultra-zero air. The channel status bar will increment as the system pressurizes the canister. The system does not generate a report via this function.
- 5 Label the canister tag as humid blank. Record the date.
- 6 Close the ultra-zero air cylinder and regulator.
- 7 Cap the Entech 4700 Precision Diluter with ¼-in male compression nuts to finger tight.
- 8 Cap the newly created humid blank with a ¼-in female compression nut.

5.4.3 Preparation of a Standard by Serially Diluting a Previously Made Standard

To obtain parts-per-billion concentrations and below, standards need to be serially diluted from their source. The Entech 4700 can do this using the re-dilute, channel 6, functionality. To re-dilute a canister:

- 1 Select a previously created standard and connect it to the re-dilute channel on the front of the Entech 4700 with a 9/16-in wrench.
Note: A best practice is to let previously created standards equilibrate for 12-24 hours prior to the re-dilution of their contents.
- 2 Enter the settings tab and select the “Configuration” from the left hand menu.
- 3 Enter the canister number into the Cylinder ID field.
- 4 Enter the nominal concentration of the standard into the “Init. Conc.” Field.
- 5 Enter the preparation date into the “Date Rcvd.” Field.
- 6 Enter the expiration date in the “Expires” column.
- 7 Save the configuration file by clicking file and selecting “save configuration.” Overwrite the existing configuration file. An example of the modified Re-Dilute channel configuration is shown below:

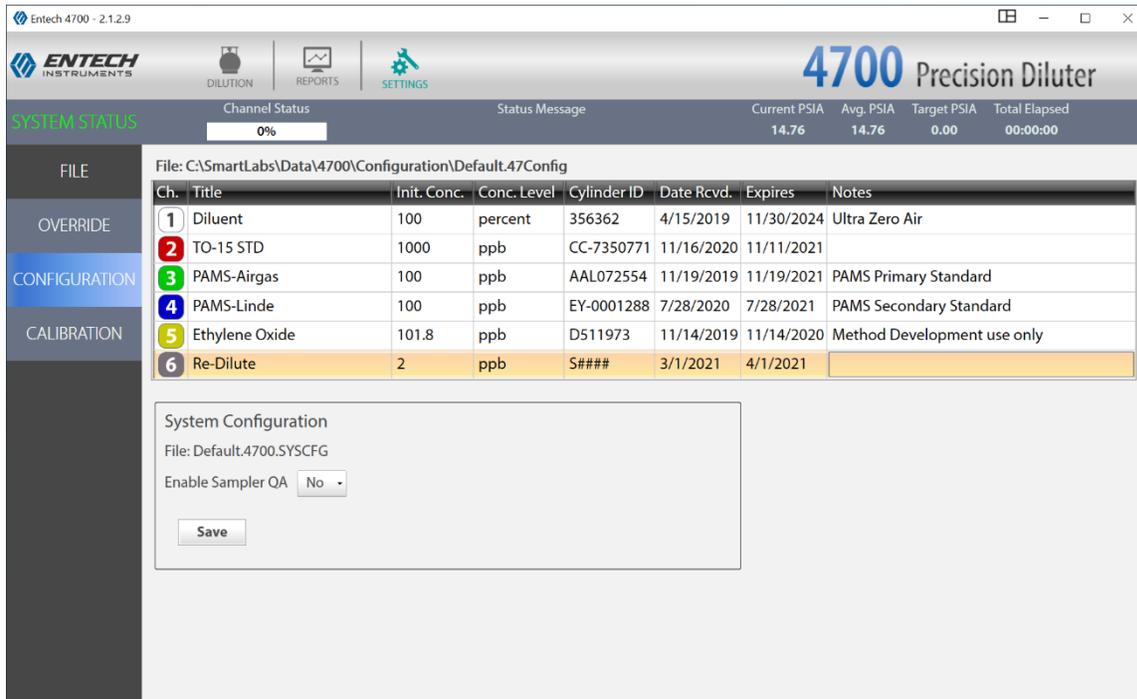


Figure 15: Entech 4700 Precision Diluter Re-Dilute Channel Configuration

- 8 Click the dilution button to navigate back to standards prep. Create a new method, as detailed in section 5.2, using the re-dilute channel as the analytical gas standard to target a desired dilution factor or concentration. An example is shown below on creating a 0.04-ppb standard from a 2-ppb standard:

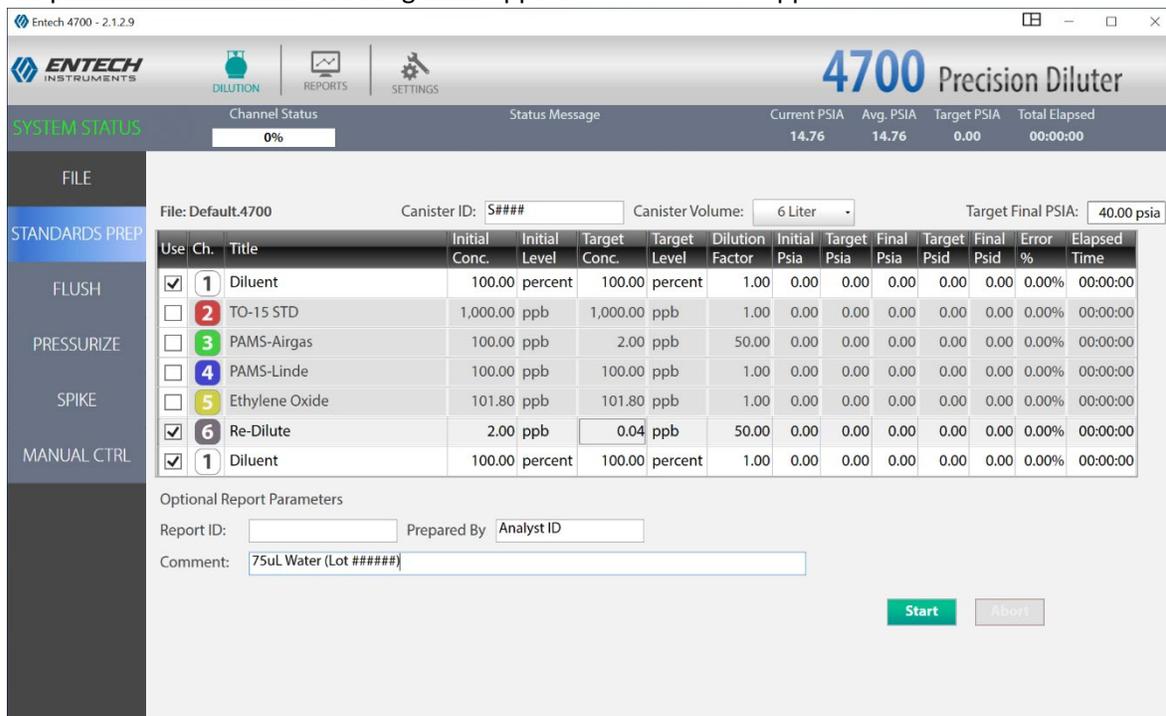


Figure 16: Entech 4700 Precision Diluter Re-Dilute Channel Method

- 9 Enter the canister number into the Canister ID, the operator initials in the prepared by field and the volume and lot number of water used in the comment field.

- 10 Press start to begin the dilution and wait for the process to complete.
- 11 Close all canisters and disconnect with a 9/16-in wrench.
- 12 Click the report tab on the top row of the Entech 4700 Precision Diluter software. The screen will populate with a dilution report for the newly created standard. Click the floppy disk icon and save the report as a PDF. Name the report in the following format: YYMMDD Standard Name Concentration Canister Number. For a canister, S1000, previously prepared on January 21st, 2021 at 2 ppbv PAMS-Airgas the report would be saved as "210121 PAMS-Airgas 2ppb CanS1000." Save the report in the report folder.
- 13 Print a copy of the 4700 Precision Diluter Standards Preparation Report and place it in the Entech 4700 Precision Diluter Binder. Initial and date the copy after reviewing it for accuracy. Cross out any errant entry with a line and writing the correct value next to it, then initial and date.
- 14 Label the canister tag with the standard name and preparation date. E.g. "PAMS-Airgas 2ppb" and the preparation date.
- 15 Return to the flush menu and flush the system with diluent only for 30 seconds to purge the system.
- 16 Cap the canister standard with a ¼-in female compression nut. A best practice is to let the prepared standard sit over-night prior to use to allow the water to interact with the canister and compounds to ascertain equilibrium.
- 17 Cap the Entech 4700 Precision Diluter with ¼-in male compression nuts to finger tight.
- 18 Cap the newly created standard with a ¼-in female compression nut.

6.0 DATA REVIEW

This section of the SOP describes steps required for the operator to perform a self/Level 1 review on the precision diluter system data. Additionally, this section describes steps required for LAB personnel not directly involved in the precision diluter operation process to perform a peer/Level 2 data review.

6.1 Self/Level 1 Precision Diluter Data Review

Review the Entech 4700 Precision Diluter Standards Preparation Report and the Entech 4700 Precision Diluter Logbook entry for completeness and accuracy. Confirm that all gas lots, DI water lot, added water volume and expiration dates are correct. Confirm that the canister ID and other information on the canister tag matches the dilution records. Initial and date both the logbook entry and standards preparation report to indicate a level 1 review has occurred and submit the logbook and binder for secondary, level 2 peer review. It is the responsibility of the primary, level 1, operator to find a suitable reviewer in a timely manner.

6.2 Peer/Level 2 Precision Diluter Data Review

Review the 4700 Precision Diluter Standards Preparation Report and logbook entry for completeness and accuracy. Make any corrections necessary by putting a line through the error, initialing and dating. Write the correction next to the errant entry. Initial and date the standards preparation report and logbook entry to indicate a level 2 peer review has occurred.

7.0 FILE MANAGEMENT

This section of the SOP describes the different files generated during the precision dilution process and the individual required to manage the file, either the operator or level 2 reviewer, or both. Files include the 4700

Precision Diluter Standards Preparation Report and COAs of gas phase analytical standards or calibration certificates for support equipment.

7.1 4700 Precision Diluter Standards Preparation Report (Operator)

The operator will store the completed 4700 Precision Diluter Standards Preparation Report in the 4700 Precision Diluter binder. The binder is located next to the diluter instrument. The raw 4700 Precision Diluter Standards Preparation Report is also stored on the precision diluter computer as a PDF.

7.2 4700 Precision Diluter Logbook Entry (Operator)

The operator will store the completed Entech 4700 Precision Diluter Pressure Calibration Template within the Entech 4700 Precision Diluter Logbook. The template can be cut and pasted into the logbook. Initial over the interface of the logbook and the printed sheet of paper. Place a piece of clear tape over the signed interface of the logbook entry.

7.3 4700 Precision Diluter Analytical Gas Standards Certificates of Analysis and Support Equipment Calibration Certificates (Operator)

The operator will store the completed COAs for all analytical gas standards employed by the diluter in the rear of the Entech 4700 Precision Diluter binder. The binder is located next to the diluter instrument. Support equipment calibration certificates shall be stored here as well: this includes the calibration certificate for the NIST-Traceable barometer and gas-tight syringe.

7.4 4700 Precision Diluter Standards Preparation Report (Peer/Level 2 Reviewer)

The peer reviewer will store the reviewed 4700 Precision Diluter Standards Preparation Report in the 4700 Precision Diluter binder. The binder is located next to the diluter instrument. The reviewer does not need to maintain this entry.

7.5 4700 Precision Diluter Logbook Entry (Peer/Level 2 Reviewer)

The operator will store the completed Entech 4700 Precision Diluter Logbook Entry Template within the Entech 4700 Precision Diluter Logbook. The reviewer does not need to maintain this entry.

8.0 FILE QUALITY ASSURANCE AND DATA HANDLING

8.1 Records Retention

Printed records will be held at the DAQ LAB for the period specified in the DAQ document retention guidelines within the 4700 Precision Diluter binder.

8.2 Quarterly Data Archival and Digitization

Printed and reviewed records from each quarter will be scanned and archived on the P: network drive in the LAB folder.

9.0 TROUBLESHOOTING AND CORRECTIVE ACTIONS

9.1 System Communication Errors

If the Entech 4700 does not connect to the PC, power off both the PC and the Entech 4700. Wait a couple minutes and power on both devices. Log in and attempt to reestablish a connection. If that fails, check the device manager for COM port settings. The software can be reinstalled using the steps in section 5.1. Lastly, replace the USB cable connecting the diluter to the computer. If none of these steps rectify the communications, contact Entech support at support@entechinst.com. **Note:** Administrative rights are required to control components in device manager.

9.2 System Leak Check Failure Corrective Action

- 1 If the 4100 Precision Diluter fails to leak check, then begin by tightening the fittings on the output line. Make sure they are swaged into place, but not overtightened. Inspect the ferrules and line for damage and deformation. Replace the ferrule or line if it is damaged. A Dremel tool will be required to remove a metal ferrule. Silonite tubing is very expensive per foot and it is preferable to replace ferrules and cut tubing to fix leaks instead of replacing an entire run of silonite tubing. Attempt a leak check again, if it passes it is okay to proceed to standard preparation.
- 2 Inspect the threads of the canister. If they are not even, run a ¼-in die over the threads to repair them. Attempt a leak check again, if it passes it is okay to proceed to standard preparation.
- 3 Connect a canister pressurized with helium at 20-30 psi to the Entech 4700 using a 9/16-in wrench.
- 4 Remove the top cover to expose the proportional valves and pressure sensor as shown below in Figure 17:

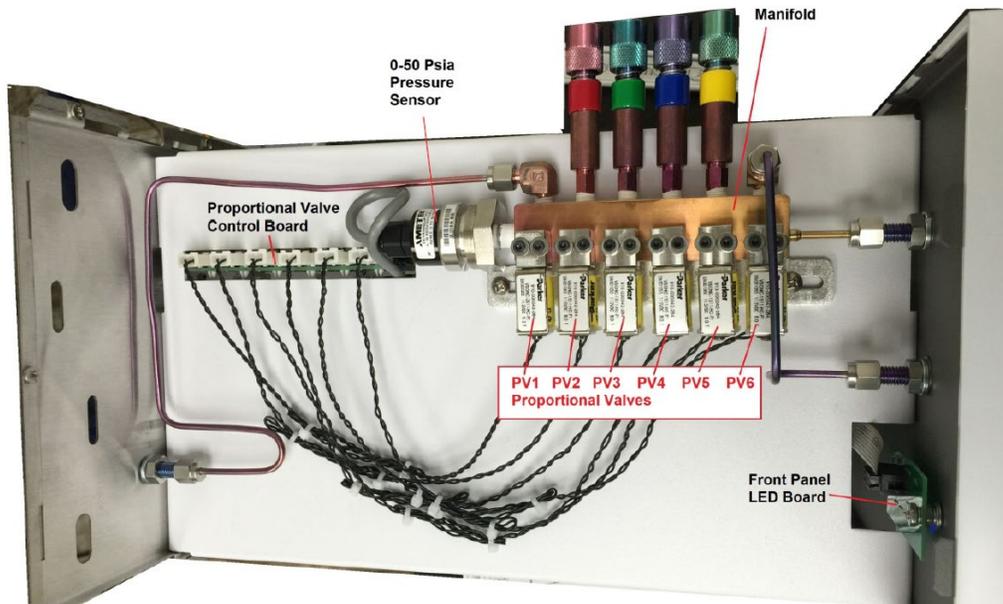


Figure 17: Entech 4700 Precision Diluter Top Panel Interior

- 5 Power on the Agilent G3388B electronic leak detector and allow it to warm up as shown below:



Figure 18: Agilent G3388B Leak Detector and Probe

The warmup procedure takes 90 seconds. Do not skip this step. The leak detector will beep once the warmup is complete. Gas can be heard audibly flowing through the meter while it is powered on.

- 6 Open the helium canister attached to the diluter and place the G3388B probe against all the fittings, valves and the pressure sensor. Wait about 10-15 seconds per point of interest and allow the gas to reach the leak detector. The detector will read R_LO and bars will fill the screen when a leak is found. The detector will also beep.
- 9 Repair or replace the leaking section and leak test the system again. For part support contact support@entechinst.com

9.3 System Reads Negative Pressures Under Full Vacuum

The Entech 4700 Precision Diluter uses an absolute psi pressure scale and should not read negative values. Perform a pressure sensor calibration if a canister under vacuum yields a negative pressure reading when opened on the dilution system. These steps are detailed in DAQ SOP-03-006.1 ECB Responsibilities.

9.4 Ambient Pressure does not Match NIST-Traceable Barometer

If the Entech 4700 Precision Diluter no longer accurately measures the ambient pressure of the laboratory, perform a pressure sensor calibration. These steps are detailed in DAQ SOP-03-006.1 ECB Responsibilities.

9.5 Standard Preparation is Not Filling Completely and is Stuck on the First Diluent Step

Verify the diluent gas is turned on and set to 50 psi. Verify the canister's beginning evacuated pressure is under 1 psi_A. If the aforementioned items were set correctly, power down the Entech 4700 Precision Diluter and its system computer. Reboot the devices and open the software. Verify the 4700 link is active and begin the standard preparation process again. If a reboot does not solve the issue, contact support@entechinst.com for further assistance.

9.6 Standard Preparation is Stopping on a Standard Fill Step or Final Diluent Step

Verify the standard gas is turned on and set to 40 psi. The pressure of the standard gas delivered to the canister must exceed the pressure inside the canister. Conduct a leak test on the Entech 4700 Precision Diluter

Top Panel Interior. The system is likely leaking. For further details see section 9.2 or contact support@entechinst.com.

9.7 System Will Not Power On

If the 4700 Precision Diluter fails to power on, the most likely culprit is the 2A fuse located on the rear of the unit. Unplug the rear power cable. The fuse holder is located next to the power cable receptacle. Push in and turn to slide the fuse out. Replace the 2A fuse. Reinstall the fuse into the unit and reconnect the power. Power on the Entech 4700 Precision Diluter to test the replacement fuse. If the unit continues to consume fuses after replacement or continues to not power on contact support@entechinst.com for further support. The rear panel of the Entech 4700 is depicted below from the Entech 4700 Precision Diluter Manual V2.0:

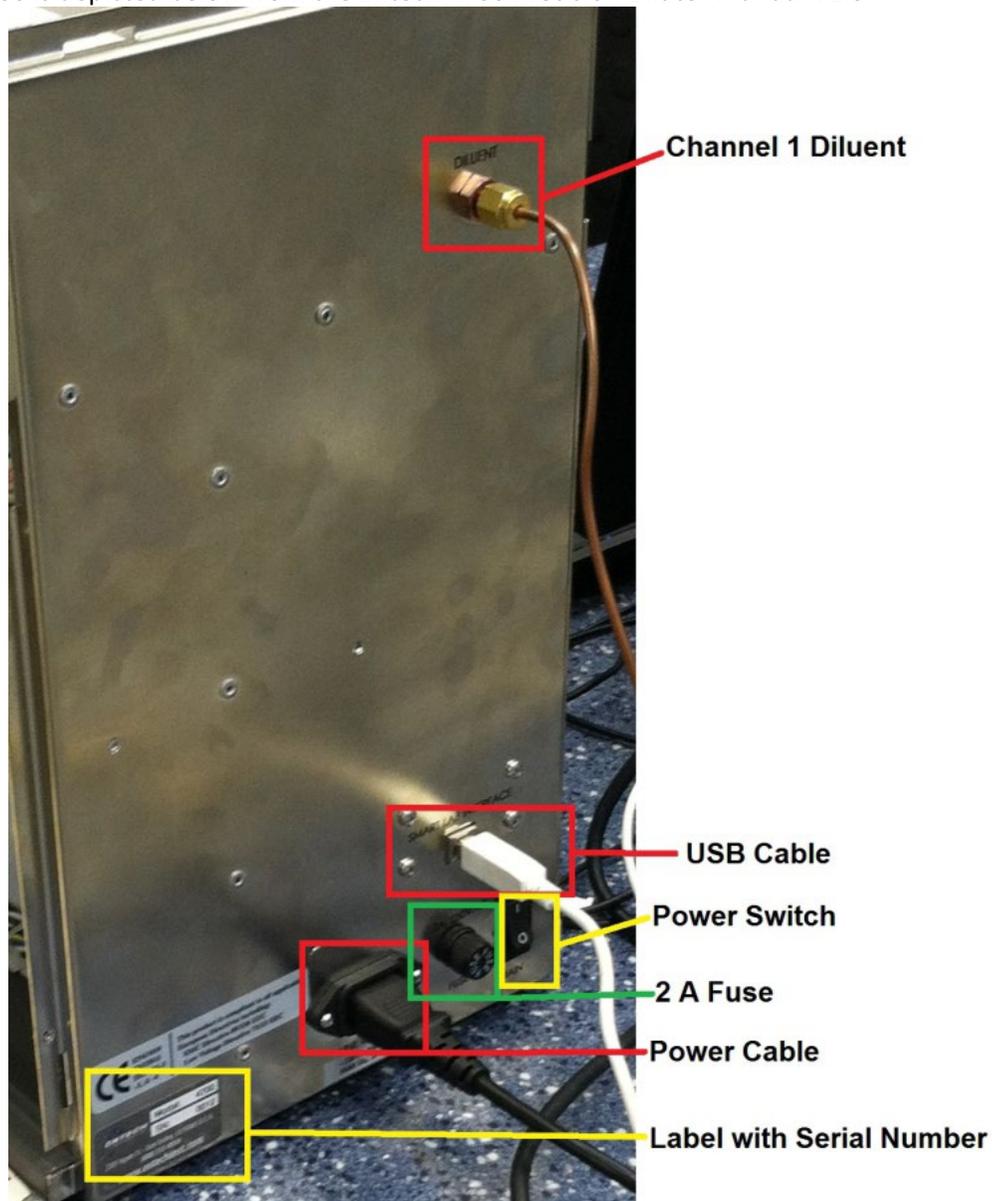


Figure 19: Rear of Entech 4700 Precision Diluter

10.0 REVISION HISTORY

1. Rev 0 – **BDV** 04/01/2021 Original Publication

11.0 REFERENCES

1. Entech Instruments (2018) 4700 Precision Diluter: Manual Version 2.0. Simi Valley, CA. Entech Instruments & Tim Raub.
2. CRC Press (2014-2015) CRC Handbook of Chemistry and Physics: 95th Edition. Bacon Raton, FL. W.M Hanyes, Ph.D, David R. Lide, Ph.D and Thomas J. Bruno, Ph.D. (Pg. 1-39)

12.0 APPENDICES

1. Appendix A – Arc3 Purity Plus Specialty Gases Grade Specification Sheet
2. Appendix B – Example Analytical Gas Standard Certificate of Analysis
3. Appendix C – Example Canister Tag
4. Appendix D – Entech 4700 Precision Diluter Logbook Entry Template
5. Appendix E – NIST-Traceable Barometer and Calibration Certificate

Appendix A – Arc3 Purity Plus Specialty Gases Grade Specification Sheet



PURE GAS GRADE SPECIFICATIONS

CONTAMINATE LEVELS (UNLESS OTHERWISE NOTED AS %)

PRODUCT	GRADE	PURITY	PART #	VALVE	O2	THC*	H2O	CO	CO2	N2
ACETYLENE										
ATOMIC ABSORPTION	2.6	99.6%	ACE-26-300	510	< 4000 PPM (combined)	-	-	-	-	-
* < 20 PPM PH3										
AIR										
ULTRA ZERO	0.1	-	AIR-UZ-300	590	19.5% - 23.5%	<0.1 ppm	<3 ppm	<1 ppm	<1 ppm	-
ZERO	1.0	-	AIR-ZE-300	590	19.5% - 23.5%	<1 ppm	-	-	-	-
EXTRA DRY	-	-	AIR-ED-300	590	19.5% - 23.5%	-	<8 ppm	-	-	-
ARGON										
RESEARCH	6.0	99.9999%	CDI-50-60	580	<0.2 ppm	<0.1 ppm	<0.2 ppm	<0.1 ppm	<0.1 ppm	<0.4 ppm
CHROMATOGRAPH	5.5	99.9995%	ARG-55-XX	580	<1 ppm	<0.1 ppm	<1 ppm	-	-	<3 ppm
NITROGEN FREE	5.0	99.9990%	ARG-NF-XX	580	<2 ppm	<0.5 ppm	<2 ppm	-	-	<4 ppm
UHP	5.0	99.999%	ARG-50-300	580	<1 ppm	<0.5 ppm	<1 ppm	-	-	-
PREPURIFIED	4.8	99.998%	ARG-48-300	580	<5 ppm	<2 ppm	<5 ppm	-	-	-
ZERO	4.8	99.998%	ARG-ZE-300	580	-	<0.5 ppm	-	-	-	-
CARBON DIOXIDE										
RESEARCH	5.0	99.999%	CDI-50-50	320	<1 ppm	<0.5 ppm	<2 ppm	<0.1 ppm	99.999%	<1 ppm
Scientific	4.8	99.998%	CDI-48-50	320	<2 ppm	<2 ppm	<3 ppm	<1 ppm	99.998%	-
LASER	4.5	99.995%	CDI-45-50	320	<5 ppm	<1 ppm	<5 ppm	-	99.995%	-
COLEMAN/ INSTRUMENT	4.0	99.99%	CDI-40-50	320	<20 ppm	-	<10 ppm	-	99.99%	<50 ppm
ANAEROBIC	3.0	99.9%	CDI-30-50	320	<20 ppm	-	-	-	99.9%	-
BONE DRY	2.8	99.8%	CDI-28-50	320	-	-	<20 ppm	-	99.8%	-
HELIUM										
GRADE 7	7.0	99.99999%	HEL-70-300	580	<50 ppb	<20 ppb	<50 ppb	<20 ppb	<20 ppb	<50 ppb
RESEARCH	6.0	99.9999%	HEL-60-300	580	<0.2 ppm	<0.1 ppm	<0.2 ppm	<0.1 ppm	<0.1 ppm	<0.4 ppm
CHROMATOGRAPH	5.5	99.9995%	HEL-55-XX	580	<1 ppm	<0.5 ppm	<1 ppm	-	-	<3 ppm
UHP	5.0	99.999%	HEL-50-300	580	<1 ppm	<0.5 ppm	<1 ppm	-	-	-
PREPURIFIED	4.7	99.997%	HEL-47-300	580	<5 ppm	-	<5 ppm	-	-	-
ZERO	4.8	99.998%	HEL-48-300	580	-	<0.5 ppm	-	-	-	-
HYDROGEN										
RESEARCH	6.0	99.9996%	HYD-60-300	350	<0.2 ppm	<0.1 ppm	<0.5 ppm	<0.1 ppm	<0.1 ppm	<0.3 ppm
Grade 5.5	5.5	99.9995%	HYD-55-300	350	<0.5 ppm	<0.2 ppm	<2 ppm	<0.2 ppm	<0.1 ppm	<2 ppm
UHP*	5.0	99.999%	HYD-50-300	350	<1 ppm	<0.5 ppm	<1 ppm	-	-	<5 ppm
ZERO	4.5	99.995%	HYD-45-300	350	-	<0.5 ppm	-	-	-	-
PREPURIFIED	4.0	99.99%	HYD-40-300	350	<20 ppm	-	<10 ppm	-	-	-
NITROGEN										
RESEARCH	6.0	99.9999%	NIT-60-300	580	<0.2 ppm	<0.1 ppm	<0.2 ppm	<0.1 ppm	<0.1 ppm	-
CHROMATOGRAPH	5.5	99.9995%	NIT-55-XX	580	<1 ppm	<0.1 ppm	<1 ppm	<1 ppm	<1 ppm	-
UHP	5.0	99.999%	NIT-50-300	580	<1 ppm	<0.5 ppm	<1 ppm	-	-	-
ZERO	4.8	99.998%	NIT-ZE-300	580	-	<0.5	-	-	-	-
PREPURIFIED	4.8	99.998%	NIT-48-300	580	<5 ppm	-	<5 ppm	-	-	-
Oxygen Free	4.8	99.998%	NIT-OF-300	580	<0.5 ppm	-	-	-	-	-
NITROUS OXIDE										
ATOMIC ABSORPTION	2.6	99.6%	N2O-26-50	326	*	-	<30 ppm	-	-	*
* N2O-AA: AIR-2000 ppm										
OXYGEN										
RESEARCH***	5.0	99.999%	OXY-50-300	540	99.999%	<0.5 ppm	<1 ppm	<1 ppm	<1 ppm	<5 ppm
UHP**	4.3	99.993%	OXY-43-300	540	99.993%	<0.5 ppm	<3 ppm	-	-	<10 ppm
ZERO	2.8	99.8%	OXY-28-300	540	99.8%	<0.5 ppm	-	-	-	-
EXTRA DRY	2.6	99.6%	OXY-26-300	540	99.6%	-	<10 ppm	-	-	-
					O2-UHP <40 ppm Ar	*O2-RESEARCH <5 ppm Ar				
ppm = Parts Per Million					ppb = Parts Per Billion			THC = Total Hydrocarbons		

Appendix B – Example Analytical Gas Standard Certificate of Analysis



Airgas Specialty Gases
Airgas USA, LLC
6141 Easton Road
Bldg 1
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

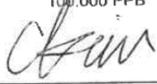
Grade of Product: CERTIFIED HYDROCARBON

Part Number:	X57NI99C15AC003	Reference Number:	160-401659192-1
Cylinder Number:	AAL072554	Cylinder Volume:	144.3 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2050 PSIG
Analysis Date:	Nov 19, 2019	Valve Outlet:	350SS
Lot Number:	160-401659192-1	Expiration Date:	Nov 19, 2021

Traceability Statement: Hydrocarbon Process standards are NIST traceable either directly by weight or by comparison to Airgas laboratory standards that are directly NIST traceable by weight.

CERTIFIED CONCENTRATIONS

Component	Requested Concentration	Reported Mole %	Accuracy
1 BUTENE	100.000 PPB	108.000 PPB	+/- 10%
1 HEXENE	100.000 PPB	98.000 PPB	+/- 10%
1 PENTENE	100.000 PPB	99.000 PPB	+/- 10%
1,2,3 TRIMETHYL BENZENE	100.000 PPB	105.000 PPB	+/- 10%
1,2,4 TRIMETHYLBENZENE	100.000 PPB	104.000 PPB	+/- 10%
1,3 DIETHYLBENZENE	100.000 PPB	97.000 PPB	+/- 10%
1,3,5 TRIMETHYL BENZENE	100.000 PPB	100.000 PPB	+/- 10%
1,4 DIETHYL BENZENE	100.000 PPB	99.000 PPB	+/- 10%
2 ETHYLTOLUENE	100.000 PPB	104.000 PPB	+/- 10%
2 METHYL PENTANE	100.000 PPB	106.000 PPB	+/- 10%
2 METHYLHEPTANE	100.000 PPB	99.000 PPB	+/- 10%
2 METHYLHEXANE	100.000 PPB	102.000 PPB	+/- 10%
2,2 DIMETHYLBUTANE	100.000 PPB	101.000 PPB	+/- 10%
2,3 DIMETHYL BUTANE	100.000 PPB	104.000 PPB	+/- 10%
2,3 DIMETHYL PENTANE	100.000 PPB	100.000 PPB	+/- 10%
2,3,4 TRIMETHYL PENTANE	100.000 PPB	99.000 PPB	+/- 10%
2,4 DIMETHYL PENTANE	100.000 PPB	102.000 PPB	+/- 10%
3 ETHYLTOLUENE	100.000 PPB	99.000 PPB	+/- 10%
3 METHYL PENTANE	100.000 PPB	105.000 PPB	+/- 10%
3 METHYLHEPTANE	100.000 PPB	102.000 PPB	+/- 10%
3 METHYLHEXANE	100.000 PPB	102.000 PPB	+/- 10%
4 ETHYL TOLUENE	100.000 PPB	95.000 PPB	+/- 10%
ACETYLENE	100.000 PPB	101.000 PPB	+/- 10%
BENZENE	100.000 PPB	100.000 PPB	+/- 10%
CIS 2 BUTENE	100.000 PPB	108.000 PPB	+/- 10%
CIS 2 PENTENE	100.000 PPB	98.000 PPB	+/- 10%
CUMENE	100.000 PPB	96.000 PPB	+/- 10%
CYCLOHEXANE	100.000 PPB	103.000 PPB	+/- 10%
CYCLOPENTANE	100.000 PPB	95.000 PPB	+/- 10%
DODECANE	100.000 PPB	103.000 PPB	+/- 10%
ETHANE	100.000 PPB	107.000 PPB	+/- 10%
ETHYL BENZENE	100.000 PPB	101.000 PPB	+/- 10%
ETHYLENE	100.000 PPB	111.000 PPB	+/- 10%
HEXANE	100.000 PPB	105.000 PPB	+/- 10%
ISOBUTANE	100.000 PPB	108.000 PPB	+/- 10%
ISOOCTANE	100.000 PPB	100.000 PPB	+/- 10%
ISOPENTANE	100.000 PPB	96.000 PPB	+/- 10%
ISOPRENE	100.000 PPB	95.000 PPB	+/- 10%
M,P XYLENE	100.000 PPB	102.000 PPB	+/- 10%
METHYL CYCLOHEXANE	100.000 PPB	102.000 PPB	+/- 10%
METHYL CYCLOPENTANE	100.000 PPB	106.000 PPB	+/- 10%
N BUTANE	100.000 PPB	107.000 PPB	+/- 10%
N DECANE	100.000 PPB	104.000 PPB	+/- 10%


Approved for Release

Page 1 of 160-401659192-1



Airgas Specialty Gases
Airgas USA, LLC
6141 Easton Road
Bldg 1
Plumsteadville, PA 18949
Airgas.com

N HEPTANE	100.000 PPB	96.000 PPB	+/- 10%
N NONANE	100.000 PPB	102.000 PPB	+/- 10%
N OCTANE	100.000 PPB	101.000 PPB	+/- 10%
N PENTANE	100.000 PPB	101.000 PPB	+/- 10%
N PROPYL BENZENE	100.000 PPB	101.000 PPB	+/- 10%
O XYLENE	100.000 PPB	100.000 PPB	+/- 10%
PROPANE	100.000 PPB	109.000 PPB	+/- 10%
PROPYLENE	100.000 PPB	107.000 PPB	+/- 10%
STYRENE	100.000 PPB	99.000 PPB	+/- 10%
TOLUENE	100.000 PPB	106.000 PPB	+/- 10%
TRANS 2 BUTENE	100.000 PPB	106.000 PPB	+/- 10%
TRANS 2 PENTENE	100.000 PPB	101.000 PPB	+/- 10%
UNDECANE	100.000 PPB	103.000 PPB	+/- 10%
NITROGEN	100.0 %	99.999429 %	+/- 2%

Permanent Notes:STD TO MIX - PAMS

Approved for Release

Appendix C – Example Canister Tag

NC DAQ LABORATORY ANALYSIS BRANCH

4403 Reedy Creek Road, Raleigh, NC 27607

SAMPLE CANISTER LABEL -- Use Black Ballpoint Ink Pen

Can Batch Number _____ Sample Number _____

Can Number _____ Sampling Site _____

Start Date _____ End Date _____

Start Pressure _____ End Pressure _____

COC Seal _____ Lab Number _____

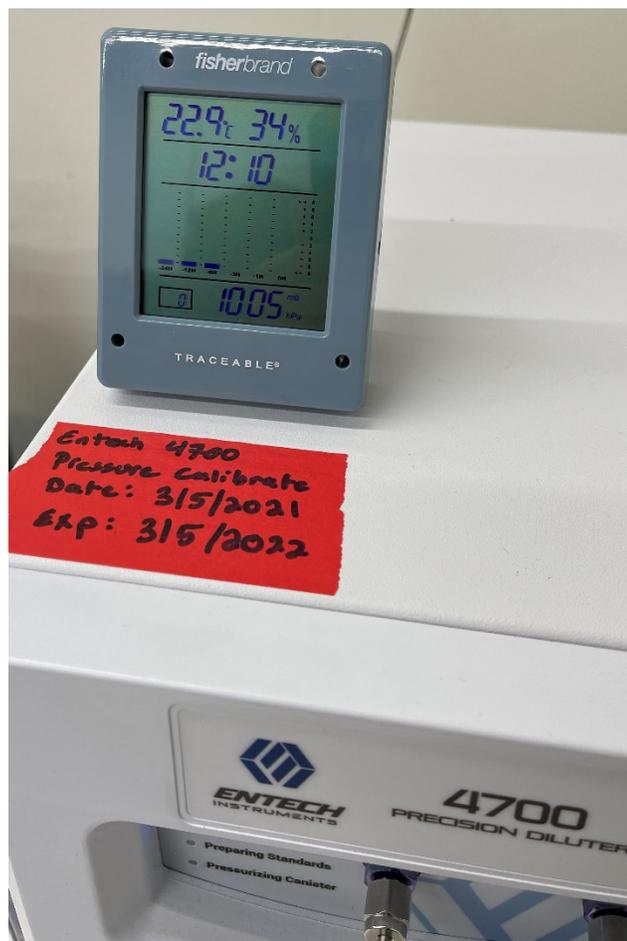
Comments _____

Appendix D – Entech 4700 Precision Diluter Logbook Entry Template

North Carolina Department of Environmental Quality, Division of Air Quality Laboratory

Entech 4700 Precision Diluter Logbook Entry Template		
Date:		
Operator ID:		
Entech 4700 S/N:	0316	
Syringe:	Hamilton Gas-Tight 100µL	
DI Water Volume (µL):		
DI Water Lot Number:		
NIST-Traceable Barometer S/N:	200810884	
System Pressure Check		
"Current PSIA" Reading		PASS CRITERIA ±0.1psi _A of Barometric Pressure
Barometric Pressure (mbar)		
Barometric Pressure (psi _A) [‡]		
[‡] Barometric Pressure is converted from mbar to psi _A via the following formula: $\text{psi}_A = (\text{Ambient Pressure}_{\text{mbar}}) (14.50377 \text{psi}_A / 1 \text{bar}) (1 \text{bar} / 1000 \text{mbar})$		
Canister Number:		
Canister Cleaning Batch Number:		
Standard Name:		
Diluent Gas Cylinder Lot:		
Analytical Gas Cylinder # or Rediluted Canister #:		
Entech 4700 Method ID:		
Barometer Expiration Date:	12/16/2021	
Leak Check Pass? (PASS CRITERIA: No more than 0.5psi _A over 30seconds)	Y N (circle one)	
4700 Pressure Calibration Expiration Date:	3/5/2022	
Level 1 Review:		
Level 2 Review:		

Appendix E – NIST-Traceable Barometer and Calibration Certificate



Fisherbrand Traceable® NIST-Traceable Barometer



**Calibration complies with ISO/IEC
17025, ANSI/NCSL Z540-1, and 9001**



Cert. No.: 6530-11810931

Traceable® Certificate of Calibration for Digital Barometer

Manufactured for and distributed by : Fisher Scientific "300 Industry Drive,,Pittsburgh,PA,15275-1001"

Instrument Identification:

Model: 14-650-118,15557603

S/N: 200810884

Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Digital Barometer	D4540001	19 Nov 2021	1000461277
Digital Thermometer	130070752	10 Mar 2021	4000-11170557
Chilled Mirror Hygrometer	44654/2H3737	25 Nov 2021	17811
Climate Chamber	W619.0019		

Certificate Information:

Technician: 57

Procedure: CAL-31

Cal Date: 16 Dec 2020

Cal Due Date: 16 Dec 2022

Test Conditions: 44.5%RH 22.06°C 1021mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
%RH	N.A.	N.A.		50.48	51	Y	47	53	0.74	>4:1
°C	N.A.	N.A.		25.21	25.1	Y	24.81	25.61	0.05	>4:1
mb/hPa	N.A.	N.A.		805.60	806	Y	802	810	0.62	>4:1
mb/hPa	N.A.	N.A.		910.40	911	Y	906	914	0.62	>4:1
mb/hPa	N.A.	N.A.		1011.77	1012	Y	1008	1016	0.62	>4:1

This certificate indicates Traceability to standards provided by (NIST) National Institute of Standards and Technology and/or a National Standards Laboratory.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO *Guide to the Expression of Uncertainty in Measurement : (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio;
Accuracy=±(Max-Min)/2; Min=As Left Nominal(Rounded) - Tolerance; Max= As Left Nominal(Rounded) + Tolerance;

Nicol Rodriguez

Nicol Rodriguez, Quality Manager

Marisa Elms

Marisa Elms, Technical Manager

Note :

Maintaining Accuracy:

In our opinion once calibrated your Digital Barometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Digital Barometer change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

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**CONTROL COMPANY 12554 Galveston RD Suite B230 Webster TX USA 77598
Phone 281 482-1714 Fax 281 482-9448 sales@control3.com www.traceable.com**

Control Company is an ISO/IEC 17025:2017 Calibration Laboratory Accredited by (A2LA) American Association for Laboratory Accreditation, Certificate No. 1750.01.
Control Company is ISO 9001:2015 Quality Certified by DNV GL, Certificate No. CERT-01805-2006-AQ-HOU-ANAB.
International Laboratory Accreditation Cooperation - Multilateral Recognition Arrangement (ILAC-MRA).