Scripps Reference Gas Calibration System for Carbon Dioxide-in-Nitrogen and Carbon Dioxide-in-Air Standards: Revision of 2012

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1 Introduction

This document follows in the sequence of technical reports documenting aspects of the calibration of carbon dioxide (CO_2) in air by the Scripps Institution of Oceanography (SIO) CO_2 Program. The most recent two of such reports were C.D. Keeling et al. [2002] and Guenther et al [2002a].

This report is the basis for an updated Scripps CO_2 scale which addresses analyses and diagnostic activities carried out on the constant volume manometer (CMM) over the past few decades, particularly incorporating additional tests done after year 2000.

The Scripps program served as the Central Calibrating Laboratory (CCL) of the Background Air Pollution Monitoring Network (BAPMoN) of the World Meteorological Organization from 1975-1995. Although the role of CCL was taken over by the NOAA Climate Monitoring and Diagnostics Laboratory in 1995, Scripps has continued to maintain an independent calibration since that time. Maintaining an independent scale was essential to ensure continuity of the long-term records of CO_2 maintained at Scripps and to allow for continuing comparisons with the NOAA scale, in order to better resolve any differences.

The propagation of the Scripps CO_2 scale since 1990 has been complicated by apparent drift in the Scripps primary references gases as determined on the constant-volume mercury-column manometer (CMM). As summarized in the previous reports, it was not easy to resolve whether this drift was caused by instability in the gases or changing systematic errors in the manometry. These inconsistencies are reflected in the fact that the Scripps CO_2 data over this period have been worked up on two different scales, one of which effectively assumes the reference gases on average have remained stable since 1985 (X99A), the other assuming the manometry has remained stable (X99B). This ambiguity in the Scripps scale has confounded attempts to reconcile the Scripps scale with NOAA.

The purpose of this report is to examine further the issues involving this scale ambiguity, with the goal of arriving at a single Scripps scale which optimally reconciles the earlier

CO_2 data with recent data, and which makes the most reasonable assumptions concerning drift in the Scripps reference gases and in the manometer. This report will advance evidence showing that drift in both the reference gases and in the manometry both occurred. The instability in the reference gases is further evaluated by examining more closely the long-term history of the concentration differences between gases as determined by infrared analysis.

This report also addresses small corrections to the Scripps CO_2 scale, not previously applied, for differences in the isotopic composition of the primary reference gases relative to background air.

The Scripps CO_2 program has relied, through nearly its full history, on CO_2 measurements made on an Applied Physics Corporation (APC) non-dispersive infrared CO_2 analyzer operated at Scripps. (Between Aug. 2012 and Aug.2013, the Scripps APC analyzer was transitioned to a Picarro 2301 analyzer between, using the same calibration strategy). The analyzer is calibrated based on suites of reference gases stored in high-pressure cylinders ("tanks"). The CO_2 mole fraction in these reference gases is assessed using a manometric analysis on the CMM. The method involves introducing an air sample from these tanks into a large (~5 liter) chamber at known pressure and temperature to determine the number of moles of sample. The CO_2 is then extracted and the CO_2 is introduced into a smaller chamber (~4cc) at known pressure and temperature to determine the number of moles of CO_2. The manometric reference gases include 12 CO_2-in-air gases in use since the early 1980's and CO_2-in-N_2 gases which were used also previously. The concentrations in these gases range from about 200 to about 500 ppm.

The full suite of CO_2-in-air reference gases was analyzed on the CMM roughly once every two years from 1981 to 1998 and then again in 2005. Each set of manometric analyses were paired with so-called "marathon tank days" in which the full suite of reference gases were analyzed on the APC system. These APC analyses were used to define a cubic relationship between so-called J-index values and the true CO_2 concentrations, as described in other technical reports [Keeling et al., 2002]. The J index is a scale which is linear in the APC response and propagated in time through a series of

short-lived secondary reference gases, which are replaced sequentially in self-consistent fashion. The cubic relationships have been found typically to be slightly different from one marathon tank day to another. The differences could arise due to drift in the secondary reference gases, drift in the non-linearity of the APC analyzer, or errors in the manometric determinations of the primaries. These cubic relationships are linearly interpolated in time between the marathon tank days, or extrapolated forward from the last tank day to the present, and yield the time-dependent relationship between the J index and true concentrations.

Each new marathon tank day provided a basis for revising the calibration of the APC analyzer (i.e. revising the cubic) back to the previous marathon tank day. The revised CO_2 values were reported as being on a new scale XYY, where YY here refers to the year of the last marathon tank day (e.g. X95). Each new scale typically only involved changes to the data since the last marathon tank day, although some of the scale changes also have entailed changes also to earlier data, as documented in earlier reports.

In principle, the manometric calibration procedure corrects for any long-term drift in the CO_2 concentration of the reference gases by virtue of the repeated manometric determinations, which automatically track and correct for this drift. In practice, however, the ability to resolve drift in the reference gases has been obscured by questions about drift of the CMM.

The reasons for the drift in the manometer have remained obscure. A particularly sensitive element of the manometer is the small chamber used to assess the molar amounts of CO_2. This chamber is nominally 4 cm^3 in volume and referred to as the "4 cc chamber". A leading hypothesis for the drift in the manometer has been changes in the effective size of the 4 cc chamber, which would lead to proportional errors in the reported manometric CO_2 mole fractions. Accordingly, the drift in the manometer has been allowed for by adjusting the apparent size of this chamber to achieve approximately constant values for the primary reference gases during the calibrations of the APC analyzer from 1985 to 1999. Significant adjustments for the drift were made for the calibrations in 1993, 1995, and 1998 [Keeling et al., 2002, Figure 4]. The manometric

determinations, adjusted retrospectively for apparent changes in the 4cc chamber in this way, formed the basis of the X99A scale [Keeling et al., 2002]. This scale, which was effectively anchored to manometry done in the mid 1980's and early 1990s, formed the basis of a crucial comparison with NOAA primary reference gases in 1999 [Guenther et al., 2002b]. Most of the recent Scripps CO_2 data has been reported on this scale or on its extension to the present.

In the case of the drift in the mid 1980's the assumption that the effective size of the 4 cc chamber changed is still defensible. However, for the drift through the 1990's subsequent work showed conclusively that the 4 cc chamber remained highly stable [Guenther et al, 2002a], which would appear to undermine the basis on which the X99A scale was based.

Even though the X99A scale is now known to be based on an incorrect assumption about why the manometer drifted, the scale is still useful as a basis for reporting CO_2 data. Being anchored to the manometry of the 1980s, the scale provides continuity to the earlier CO_2 data at Scripps. The scale was shown to be highly consistent with the NOAA determinations in 1999. Furthermore, the extrapolation over the troubling period in the 1990s is based on a very clear assumption; namely, that the primary reference gases have remained stable. An important goal of this report is to examine the available constraints on this assumption based on the longer history of these and other gases.

Since 1999, the X99A scale has been propagated forward under the assumption that the values of the primary reference gases remained stable since 1998. Thus for marathon tank days in 2001, 2003, 2005 and 2008, these gases were assigned the same concentrations as had been used for their values for the marathon tank day in 1999, thus forming the basis of the X01A, X03A, X05A and X08A scales. The 1999 marathon tank day used values from 1998 manometry that allowed for a variable 4cc volume. Note that the method of propagating the scale after 1999 differs from the method used for the period of the 1990's. In the earlier period, the marathon tank day indices were paired with the nearest (in time) measurements on the CMM. The latter were calculated using adjusted 4cc chamber volumes that allowed the overall reference gas concentrations to remain constant. The eight different sets of marathon tank days on the APC used five sets

of manometrically - determined values based upon adjusted 4 cc volumes in the CMM. For those years with no manometric measurements the set from the nearest year was chosen. The adjustments kept the reference gas concentrations approximately, but not exactly constant. Only in the latter period were the reference gas concentrations kept exactly constant.

In this report the history of manometer drift will be reviewed following new evidence of changes in volumes of plenums used in the small chamber calibration and of drift in the thermometers. These two phenomena give new insight into the behavior of the small chamber's volume over time and allow reassessment of all manometric determinations since 1974. This work supports the introduction of a new calibration scale for 2012, the X12 scale.

2 Description and Operation of the Constant-Volume Mercury-Column Manometer (CMM)

2.1 Description of the CMM

The CMM at SIO is a mercury manometer assembly adapted to the measurement of quantities of gas as well as pressure. As such, each manometer (the CMM comprises three independent manometers) has three "legs" connected to each other and filled with mercury. See the detailed diagrams in Keeling et al (1986) and Figure 1.

In each manometer, one leg is kept evacuated above the mercury (the "vacuum column"), one leg contains designated volumes demarcated by glass pointers (the "sample column"), and the third leg is connected to controllable sources of pressure and vacuum (the "control column"). The mercury levels in the vacuum and sample columns are simultaneously raised or lowered by the application of pressure or vacuum to the control column. The lower parts of the three columns (containing mercury) are connected to each other via 3 mm ID capillary tubing so that mercury movement is optimally slow.

The CMM consists of three of these manometers. Columns 1 and 3 (numbered from the left) are the vacuum and sample columns, respectively, of an alternate small-chamber manometer that has never been used. Columns 2 and 4 are the vacuum and sample

columns, respectively, of the primary small-chamber manometer. Column 4 contains five "chambers" with volumes demarcated by glass pointers mounted in the glass tubing of the columns. The largest chamber (nominally 325 cc) includes all the other volumes and is defined by a stopcock at the top of the column, by the mercury surface at the pointer and by the closed-end part of the column. The remaining volumes of nominally 64 cc, 16 cc, 4 cc, and 1 cc, are defined by the mercury surface at the specific glass pointers and by the closed-end part of the column.

The large-chamber manometer comprises three sample columns, 5, 6, and 7, and one vacuum column, 8, on the far right. These columns are all connected by the lower capillary tubing (filled with mercury) to each other and to the large-chamber manometer control column. The sample columns of the large-chamber manometer each contain two volumes, both demarcated by the mercury surface aligned at the same glass pointer and by the stopcocks at the top of the columns. The total volumes are nominally 5000 cc and 1000 cc, the latter obtained by closing the stopcock on a nominally 4000 cc glass flask attached to the column.

All of the columns are connected at the top with glass stopcocks and manifolds to each other and to the associated vacuum line. Gas and vacuum can thus be introduced into any of the columns and gas transferred between columns. The two control columns used are independent of each other and connected to a vacuum pump and a cylinder of N_2 gas for pressure, with valving to allow precise control of the mercury levels.

The entire manometer assembly is enclosed in a cabinet which is an "air bath," having five air circulating fans with motors isolated from the interior of the cabinet to control heat and vibration. The upper part of the front of the manometer cabinet has double-glazed windows. In front of the cabinet a custom-built high-precision cathetometer is mounted on a pedestal so that its telescope can be focused on the mercury columns through the glass windows. The cathetometer telescope is attached to a 1 mm pitch lead screw and contains a cross hair that can be aligned with the mercury surfaces. The lead screw has counters and a manual control that allow a readability of 0.002 mm over a

range of one meter (the least count of the cathetometer is 0.01 mm). See Section 8 and Figure 1.

Temperatures within the cabinet are read using the cathetometer telescope on a mercury thermometer mounted near the 4 cc volume chamber. Six other thermometers of the same type are mounted inside the cabinet and are also read routinely to monitor gradients. The temperature read on the primary thermometer in the air bath (No. 6112) is assigned to the gas and to the mercury for a measurement. See Section 4 of this report for details on the thermometer calibration.

2.2 Procedure for Determination of Mole Fraction of CO_2 in Air

A CO_2-in-air reference gas is attached to a pressure regulator that is connected via stainless steel tubing to an entry point on the CMM's associated vacuum line. The gas is flowed slowly through a thimble trap cooled to dry ice temperature (-78 °C) and thence through glass manifolds into one of the sample columns of the large-chamber manometer (routinely sample column 5). Pressure is applied to the control leg of the large-chamber manometer to maintain the mercury level in the sample column at the glass pointer, and causing the mercury level in the vacuum column (8) to rise. Filling the five-liter volume to a pressure of about 600 mm of mercury requires about 10 minutes.

After temperature equilibration for at least one hour, the mercury is raised to within approximately 0.2 mm of the pointer and stabilized. The sample column height is measured with the cathetometer, followed by the vacuum column height and the temperature. Finally the sample column height is measured again to assure stability. With the volume of the chamber known and the temperature and pressure measured, the number of moles of "total gas" is calculated from the gas law, using the temperature-dependent "second virial coefficient" for air (or the appropriate virial coefficients for another gas such as N_2 for a CO_2-in- N_2 reference gas).

The next step is to extract cryogenically the condensable gases at liquid N_2 temperature (77 K). The 5-liter sample of gas is pumped through a spherical trap located on the associated vacuum line and kept filled with liquid N_2. The extraction rate is kept slow by throttling the pressure entering the trap to 1 cm mercury or less. For an air reference gas,

the perceptible gases extracted are CO_2 and N_20 (approximately 0.1% of the CO_2) and any residual water.

After the extraction is complete, the gas is transferred by a series of sublimations at dry ice temperature into the 4 cc chamber of the small-chamber manometer sample column 4. Three sublimations are routinely done: dry ice slurry applied to sample frozen at liquid N_2 temperature to a destination trap frozen at liquid N_2. When the final transfer into the closed-end portion of the small-chamber manometer is complete, pressure is applied to the control leg of the small-chamber manometer to raise the mercury level in column 4 above the "entry tube" into the closed-end portion. The sample is then allowed to thaw.

After temperature equilibration, the mercury level is slowly raised to a level just below contact with the pointer. By experience, this level is visually as close to the pointer as can be managed without "prematurely" making contact with the pointer. Normally this first-stage mercury level is 0.03 mm or less below the pointer. The thermometer and then the small-chamber manometer vacuum column (2) height are then read. The mercury is then slowly raised with small increments of added pressure until contact with the pointer just occurs. The sample column mercury height is then measured (second stage), followed by the second vacuum column height and the temperature. The before/after vacuum column heights are usually 0.1 to 0.2 mm apart. Averages are made of the before/after contact mercury heights and temperatures (usually within 0.02 °C of each other) and recorded for further processing.

With the volume of the chamber known and the temperature and pressure measured, the number of moles of CO_2 is calculated from the gas law, using the temperature-dependent "second virial coefficient" for CO_2. The moles of CO_2 divided by the moles of total gas yields directly the mole fraction (mixing ratio) of CO_2 (including N_20 - see below) in the air reference gas.

2.3 Meniscus corrections

The vacuum columns and most of the sample columns at the pointers delineating the “constant volume” chambers in the CMM have an I.D. of 1.9 cm (1” gauge glass). However the 4cc chamber has an I.D. of 0.95 cm at the pointer defining its volume.

Consequently a significant “meniscus correction” must be measured and applied to account for the depression of the mercury in the smaller tube. The only way to measure this effect is to compare the column heights of the small manometer (sample column versus vacuum column) with a vacuum in each column. The correction is approximately 0.3 mm in magnitude. The meniscus correction difference is subtracted from mercury height differences for measurements of CO_2 in the 4cc chamber. Corrections were also measured for the large volume manometer, where the columns are of identical nominal diameters. In this case the corrections are more properly termed “column corrections” and if non-zero are presumably caused by an out-of- level swing in the telescope of the cathetometer.

Meniscus corrections were measured periodically during manometric measurement periods. The standard procedure (for the small manometer 4 cc chamber) was to evacuate the sample column and check the vacuum in the vacuum column. The mercury was then raised to “close” to the pointer in the 4 cc chamber. The control column stopcock was closed to prevent drift during the measurements. Then the sample and vacuum columns were alternately measured 10 times each, with each measurement being the average of two cathetometer cross hair settings on the surface of the mercury. The determined correction was the average of these 10 column height differences. The large manometer corrections were measured in the same way, except that the vacuum and sample columns could be connected; therefore an identical vacuum in each column was assured.

Variation in the meniscus corrections should be small. However, some effects causing variation were identified during the measurements. One that is always present is variation in the level of the swing of the cathetometer scope between the columns being compared. This effect causes the magnitude of the “column corrections” measured for columns with identical diameters, for example the large manometer corrections. There is a bubble level on the cathetometer scope. The level was checked frequently and occasionally adjusted. Small changes in the level observed with the bubble seemed to occur randomly and were observed but not always corrected, due to the imprecise nature of the leveling adjustments.

A second effect observed in the small manometer corrections apparently depended upon the distance that the mercury level was set below the pointer. The "jumping mercury problem" (Guenther and Keeling, Manometer Report III, 1981), probably due to electrostatic effects, in some cases required the mercury level to be set farther away from the pointer, whereas when absent or small the mercury could be closer. The mercury level had to be set sufficiently close to the pointer for the meniscus reader (permanently mounted behind the 4 cc pointer) to properly delineate the mercury surface. It appeared that the closer the mercury was to the pointer the larger (more negative) the meniscus correction. During the "dirty mercury" period in 1984 the pointer could be approached more closely and the correction was larger.

Figure 2 shows the measured meniscus corrections for both the 4cc chamber column and the large volume column. These measurements are also listed in Tables 1 and 2. As well as showing quasi-random scatter, there appear to be two significant shifts, one occurring at the time the manometer was cleaned in 1985, and one occurring between 1999 and 2004, during a long hiatus in manometer usage. For the latest revision of the manometric analysis reflected in this report, we have chosen to apply constant meniscus corrections over each of the three periods demarked by these shifts, as indicated by the solid black lines in Figure 2. An exception to this procedure is that the meniscus corrections applied for calibration of the chamber volumes were mostly based on concurrent measurements and not on long-term averages. The meniscus corrections used for the chamber calibrations are separately indicated in Figure 2. Previous reports used meniscus corrections that were also sometimes averaged over certain periods, but less systematically. The meniscus revisions relative to previous reports cause changes in CO_2 mole fractions of the primary air manometric reference gases ("white stripes") of at most 0.15 ppm for the calibrations made in 1998, while the changes produced in other years' white stripe determinations are less than 0.06 ppm.

2.4 N_2O corrections

The manometric analysis of reference gases involves the cryogenic extraction of the CO_2 gas fraction at liquid nitrogen temperatures. For whole air reference gases, this fraction also contains N_2O gas, present at the level of approximately one part in 1000 (~ 0.3 ppm).

The mole fractions of N_2O gas in the primary air manometric reference gases ("white stripes"), as well as a some others, have been measured in the laboratory of Professor Ray Weiss at SIO using gas chromatography (flame ionization detector). The measured N_2O content of compressed air in cylinders filled at our laboratory with unmodified CO_2 mole fractions are within 0.02 ppm of the average atmospheric mole fraction, taken to be 0.31 ppm. The suite of 11 primary air reference gases varied between 0.24 and 0.37 ppm N_2O. Gases with CO_2 partially removed during cylinder filling have the largest deviations from 0.31 ppm. N_2O corrections applied to manometric measurements of air reference gases are listed in Appendix A, Table A7. The nominal value of 0.31 ppm has been applied to those gases not analyzed for N_2O.

3 Volume Calibrations of Glass Plenums

The volume of the small (nominally 4 cc) chamber of the CMM since 1974 has been calibrated with reference to the volumes of a set of glass containers ("plenums"). The original set of plenums range in size from 1.3 cc to 2.3 cc; their volumes are determined by weighing them filled with contained liquid. The first volume calibrations were done using mercury in 1974 by J. A. Adams [1977] with results reported in Guenther [1981] and Keeling et al., [1986].

In 1999 G. Emanuele utilized improved balance technology to recalibrate the plenum volumes by weighing them filled with water, to acceptable precision [Guenther et al., 2002a]. The water used was from a Milli-Q type filtration system that was degassed by being evacuated and allowed to boil at a slow controlled rate for roughly 1.5 hours. Emanuele's volumes were smaller on average than the 1974 values by one part in 2350. At the time we considered that the difference in some way was caused by different characteristics of the liquid used (e.g. due to interaction with grease near the stopcock), and we normalized the water results to the mercury results for a time. G. Emanuele repeated the water calibrations in 2007 and found a further decrease in volumes. Finally, later in 2007, P. Guenther made calibrations using mercury, for the first time since 1974. The results quite closely confirmed the 2007 water calibrations. We then revised our

approach to consider that the measured volume changes were "real" and henceforth have given equal weight to all of the volume calibrations.
The original data and resulting volumes of the entire set of plenum volume calibrations are reported in Table A1.

We hypothesize that the volumes of the plenums have changed by the measured amounts during the 25 to 33 year period. Support for this conclusion is found in the phenomenon called "zero creep," documented for mercury thermometers [Douglas, 1966]. The literature we have found mainly addresses this relatively short-term phenomenon in glass thermometers that have been heated over the transition temperature [Hall and Leaver, 1961]. For Pyrex glass this temperature is 550 °C. During their lifetime the plenums have been "ashed" or possibly even annealed usually at least once during every year in which they were used, in order to clean them thoroughly of grease. The ashing temperature has been 510 to 525 °C, while the annealing temperature is 565 °C. We have found in the laboratory notebooks documentation of the plenums being placed in the glass oven 12 times, six between 1974 and early 1999 and six between late 1999 and 2007. There are also reports in the literature of a decrease in the volume of mercury thermometer bulbs and capillaries over many years at room temperatures. This slow drift is called "secular change." A review article [Nemilov, 2003] cites studies of this phenomenon, some dated in the late 1800's.

In August 2007, D. Lowe and P. Guenther attempted to measure a physical change in the plenums. They assumed that the volume change would cause the originally round cross section of the plenum tube to collapse slightly to an elliptical cross section (the plenums had been placed horizontally in the glass annealing oven). The O.D. of the plenum tubes were measured in two axes using a micrometer and compared to the measured O.D. of 1/4" O.D. glass tubing. The results indicated measurable eccentricity in the plenums compared to the new tubing, but it was random in direction rather than always in the direction of gravity, and the magnitude of the implied volume differences was between 1 in 10,000 and 1 in 50,000 rather than close to 1 in 2350. It is possible that the O.D. measurements did not reflect the actual change in volume. For instance, the length could have changed (note that the plenums were stored for long periods (at room temperature)

in a vertical position). We postulate that the plenums have changed in volume, due in part to repeated exposures to high temperatures, notwithstanding the negative result of physical measurements.

The original plenums are numbered P01 to P07. The table also includes plenums that have not been used for 4cc chamber volume calibrations. For instance, plenum number P13 is actually the nominally 4000 cc bulb mounted inside the CMM cabinet as part of one of the nominally 5000 cc chambers. It was removed from the cabinet and weighed with and without water to determine its volume in 1974 and in 2004. It serves as the "plenum" to calibrate the volume of the large manometer 5000 cc chamber by transfer of CO_2 gas (see Section 7). Some plenums have been used only to calibrate the chamber volume of the electronic manometers. There is a set of eight larger plenums with volumes ranging from 7 cc to 20 cc (with an "L" prefix). These larger plenums were used to calibrate the CMM 4 cc chamber in the post- renovation period (2004 - 2010). The larger plenums (except for L02) were calibrated for volume only with contained water, beginning in 2007.

There were four sets of volume calibrations of the original set of plenums. In 1974 and 2007 volume calibrations were made with contained mercury, and in 1999 and 2007 with contained water. We have made a linear fit to each plenum volume as a function of time, and choose the volume to be used for a particular CMM small chamber calibration based on the linear fit.

Figure 3 shows all of the plenum volume calibrations for five (P01, P02, P03, P06, P07) of the original seven plenums versus time, and also linear fits to the data. Plenums P04 and P05 are not shown because they exhibited aberrant behavior. The small chamber calibrations in 1985 using plenums P04 and P05 were very different from those using the other five plenums and were rejected. It seemed that the volumes of the two plenums had changed anomalously between 1974 and 1985. Small chamber calibrations were made with P04 and P05 again in 1988, and again rejected. Since then those two plenums were not used again for 4cc chamber calibrations.

Figure 3 also shows a time plot for volume calibrations of Plenum L02, although it was used for small chamber volume calibrations only in 2008 and 2009. It is noteworthy that this larger plenum (11.09 cc) shows little change in volume between 1974 and 2007, possibly because it did not go into the glass oven during the intervening period or because its larger size made it less sensitive to the factors impacting the smaller plenums. The calibrations in 1974 were done using mercury, while those in 2007 used water. The other two larger plenums with calibrations in the 1970's and 2000's are P09 (51.4 cc) and P11 (270.8 cc). Plenum P09 was calibrated for volume in 1974 and in 2008, in both cases using water, and with little difference between the two sets (1 in 36000), while P11 was calibrated in 1976 and in 2008, also using water, with a one part in 3000 difference between the sets. Neither of these plenums has been used to calibrate the CMM 4 cc chamber.

4 CMM Thermometer Drift and Corrections

Seven mercury-in-glass thermometers are mounted inside the CMM cabinet. The thermometers were made by W.H. Kessler Co., Inc. They are 1/50 ºC graduated (i.e. 0.02 ºC) and have a range of 17.90 ºC to 28.10 ºC. The total outside length is approx. 20 cm with an O.D. of approx. 1 cm. Inside the outside tube is the actual mercury expansion tube of approx. 3 mm O.D. with a glass graduated card mounted behind. The scale sensitivity is approximately the optimum of 1 cm per ºC. The rather large mercury reservoir is approximately 2 cm long and 1 cm O.D. The first mention in the CMM laboratory notebook of the set of thermometers was on 30 May 1961. We have not been able to find any information about the original calibration of the thermometers. P. Guenther contacted the company in 2006 and found that that they have no information for products that old.

The locations of the thermometers in the CMM cabinet have remained essentially the same since 1969 (see Figure 2 in Manometer Report III [Guenther and Keeling, 1981]. Corrections determined in 1968 by E. Atlas for six of the thermometers relative to the seventh range from +0.03 ºC to -0.03 ºC. Over the years of CMM operation since 1969, the uncorrected temperature as read on thermometer #6112 (placed ~4cm from 4 cc

pointer of the small manometer) has been recorded as the temperature of manometric measurements, both on the small and large manometers.

4.1 Thermometer Calibration

The seven CMM mercury thermometers were calibrated in May 2006 by comparing them to a certified NIST-traceable standard thermistor (Hart Scientific "Super Thermistor"). The thermistor had also been calibrated versus traceable standards by R. Williams at the Oceanographic Data Facility at SIO and found to be accurate to within 0.01 ºC. All seven of the thermometers read about 0.1 ºC higher than the standard. The average correction for #6112 was -0.11 ºC.

The relative differences between the thermometers in 2006 can be compared to those of E. Atlas in 1968. After applying the 2006 calibration corrections, they range from +0.05 ºC to -0.01 ºC. The average difference (between the six differences) is +0.017 ºC (s_i = 0.010 ºC) (2006 - 1968) with no 2006 relative correction lower than its counterpart in 1968. We conclude that the Atlas relative corrections were quite good and imply that any changes in the calibrations of the thermometers since 1968 are similar for all seven thermometers. The results also may imply that the original differences in absolute calibrations were greater than 0.01 ºC, up to 0.03 ºC.

4.2 Discussion

We have found in the literature mention of instability of zero in glass thermometers, identified as a "slow drift known as the secular change" [Van Dijk et al., 1958]. Further, "the secular change normally takes the form of a slow rise of zero during storage, the rise being accelerated by exposure to high temperatures." Unlike the plenums discussed above, the CMM thermometers have not been exposed to high temperatures since their manufacture. We have not found any information that would allow estimation of the magnitude of secular change to be expected for the thermometers, although the review paper cited previously [Nemilov, 2003] does refer to a number of studies, mostly in Germany and done as long ago as the 1880's.

Our own comparisons of the seven thermometers with each other might indicate that the original accuracy of the thermometers was +/- 0.03 ºC as discussed above. Nevertheless, we have chosen to assume that the thermometers when purchased in 1961 were accurately calibrated (*i.e*. traceable to NBS) to 0.01 ºC. Additionally, we assume that the thermometers had changed between their installations in the CMM in 1961 until their calibration in 2006, due to slow secular change at room temperature. By May 2006 they had drifted as measured, positively by 0.11 ºC. We also make a slight correction for the change in temperature scales. We assume that the thermometers in 1961 were correct to 0.01 ºC in the International Practical Temperature Scale of 1948 (IPTS-48) and that the 2006 absolute calibration of the Hart Scientific thermistor is with reference to the International Temperature Scale of 1990 (ITS-90). Thus the two absolute calibration points for thermometer #6112 are -0.01 ºC on 31 May 1961 (corrected to the 1990 scale) and -0.11 ºC on 12 May 2006. We calculate the appropriate correction for all CMM measurement temperatures from a linear fit of the two points with time. This correction is applied in the MATLAB code *cdmntempcor.m* presented in Appendix C.

5 Constants Currently used in Manometric Calculations

Since completion of the X99A scale, we have made some small adjustments to the values of certain physical constants used in the workup. These changes have generally arisen from adjustments between the late 1960s and the present to the values as accepted in the scientific community. With the exception of thermometer calibrations discussed in the previous section, even the largest change in these constant values has a fairly small effect on final mole fraction determinations. Changes in mole fractions that result from incorporating each of these adjustments is of order parts in 100,000.

5.1 True Constants

5.1.1 Molar Gas Constant, R

R= 8.314472 Pa m^3 K^{-1} mol^{-1} (SI units)

R= 8.314472 J /mol K (8.314472*10^7 erg/mol K used in CMM calculations)

R= 6.236367*10^{-2} Torr m^3/mol K (used in ECM calculations)

From on-line Handbook of Chemistry and Physics. Value used in previous reports was $8.31436*10^7$ erg/mol K from early 1970's Handbook.

[Mohr and Taylor, 2005]

The change in R is about 1.3 parts in 100,000

5.1.2 Acceleration due to Gravity, g

$g = 9.79537$ m/s^2 = 979.537 cm/s^2

Measured in 2317 Ritter Hall (now 314 RH) by Jeff Ridgway of IGPP in May 1996. Benchmark on bluff near old snack bar is 979.5397 Gal, which is in good agreement with RH measurement, given -.000309 Gal/m of altitude. Value used in previous reports was 9.79558 m/s^2 (interpolated from Handbook tabular values (for 32° 52' N and zero altitude).

The standard acceleration due to gravity used for converting mercury column heights to pressure units (nominally in terms of pressure generated by a mercury column of unit length and assigned density 13595.1 kg/m^3 at 0 °C at approx. 45° N latitude) is 980.665 Gal. (Note that this value is not a measured or modeled value.)

Reference for this last is the website for the National Physical Laboratory (UK) (http://www.npl.co.uk/reference/measurement-units/)

The change in g is about 2.1 parts in 100,000.

5.1.3 Temperature Scales

We define 0 °C as 273.15 K.

For purposes of relating temperatures measured in the early 1960's to the present, one needs to account for changes in definition of temperature scales. According to a table in the on-line Handbook of Chemistry and Physics, the following relationship exists between the International Practical Temperature Scale of 1948 (IPTS-48) and the International Temperature Scale of 1990

(ITS-90):

at 0 °C t_{90}-t_{48} = 0.000 °C

at 10 °C t_{90}-t_{48} = -0.006 °C

at 20 °C t_{90}-t_{48} = -0.012 °C

at 30 °C t_{90}-t_{48} = -0.016 °C

The correction for temperatures near 20 °C is $t_{90} = t_{48}$ -0.012, or to correct from temperatures presumed to be in the IPTS-48 scale, subtract 0.01 °C to find the ITS-90 value.

5.1.4 Pressure Conversion Constants

The SI unit of pressure, the pascal (Pa), is defined as one Newton per square meter.

The bar is 10^5 Pa exactly.

The atmosphere (atm) is 101,325 Pa exactly.

The torr is 1/760 atm exactly.

Therefore: torr = 101325/760 Pa = 133.3224… Pa

Also: pascal = 760/101325 torr = $7.500616*10^{-3}$ torr = $7.500616*10^{-4}$ dynes/cm^2

mmHg definition: .001 m *13595.1 kg/m^3*9.80665 m/s^2 = 133.322387415 Pa (exactly)

torr definition: 101325 Pa/atm /760 torr/atm = 133.322368421…Pa (an infinitely long, periodically repeating decimal).

Thus the mmHg and torr differ by less than 2 parts in 10 million.

5.1.5 (Weight) Buoyancy Correction for Calibration of Volume of Apparatus

The general equation for the air buoyancy correction applied to the apparent weight in air of a sample contained in a chamber in order to calculate the true mass can be expressed as follows:

$m = w(1-\rho_a/\rho_w)/(1- \rho_a/\rho_s)$,

where ρ is the density of air (a), the weights (w) and the sample (s) being weighed.

If the chamber being calibrated for volume is evacuated before making the "empty" weighing, the ρ_a for the sample buoyancy correction in the denominator is zero; thus the denominator is equal to 1 and there is no correction for the buoyancy of the sample. The buoyancy for the weights is applied in the numerator. The density of air at sea level is taken to be 0.0012 g/cc and the density of stainless steel weights to be 8.00 g/cc. Thus the factor in the numerator becomes:

$$1-.0012/8 = 1-.00015 = 0.99985$$

and

$$m_s = w_s(.99985)$$

Reference: [DOE, 1994]

5.2 Temperature Dependent Quantities

5.2.1 Density of Mercury, ρ (Hg)

$$\rho(t) = \rho(t0) / (1+ a_0t + a_1t^2 + a_2t^3 + a_3t^4)$$

where t is in ºC. and

$\rho(t0) = 13595.0828$ kg m^{-3} (density of Hg at 0 ºC)

$a_0 = 1.815868*10^{-4}$

$a_1 = 5.4583*10^{-9}$

$a_2 = 3.4980*10^{-11}$

$a_3 = 1.5558*10^{-14}$

[Bettin and Fehlauer, 2004]

This equation reproduces the table in the Handbook of Chemistry and Physics to .0001 g/cm^3. In previous reports, fits were made to the tabular values in the Handbook (given in the obsolete g/ml that is not equal to g/cm^3) to find interpolated values and then converted to g/cm^3.

5.2.2 Density of Water, ρ (H_2O)

The density of standard mean ocean water (SMOW), free from dissolved salts and gases, and at a pressure of 101325 Pa and at temperature t (ºC), expressed in terms of the ITS-90 temperature scale is given as:

$$\rho = a_5 [1-((t+a_1)^2(t+a_2))/(a_3 (t+a_4))]$$

where

$a_1 = -3.983035$ ºC

$a_2 = 301.797$ ºC

$a_3 = 522528.9$ ºC^2

$a_4 = 69.34881$ ºC

$a_5 = 999.974950$ kg m^{-3}

[Tanaka et al., 2001].

The equation matches the detailed tabular values (to 0.1 ºC) given in the on-line version of the Handbook of Chemistry and Physics to a part in several million. In previous reports, fits were made to tabular values (given to 1 ºC) in the Handbook to find interpolated values.

The term SMOW refers to a certain isotopic abundance. For tap water the often assumed value of 999.972 kg m^{-3} for a_5 should be used, accounting for a difference of approximately three parts per million. We have elected to use the SMOW version of the density equation as written above.

5.2.3 Second Virial Coefficient: CO_2

$B\ (cm^3/mol) = 57.400-3.88290*10^4/T+4.2899*10^5/T^2-1.4661*10^9/T^3$

Where T = temperature in Kelvin

[Dymond et al., 2002, page 28]

The temperature dependency equations given in this reference are preceded by the following statement:

"Recommended values given by the following equation whose coefficients were obtained by a weighted least square fit of the selected experimental values."

5.2.4 Second Virial Coefficient: N_2

$B\ (cm^3/mol) = 40.286 - 9.33780*10^3/T-1.4164*10^6/T^2+6.1253*10^7/T^3-2.7198*10^9/T^4$

[Dymond et al., 2002, page 69]

5.2.5 Second Virial Coefficient: O_2

$B\ (cm^3/mol) = 42.859-1.7696*10^4/T+5.2007*10^5/T^2-1.6393*10^8/T^3+5.0855*10^9/T^4$

[Dymond et al., 2002, page 75]

5.2.6 Second Virial Coefficient: Air (CO_2-free)

$B\ (cm^3/mol) = -144.45932+.719291*T-8.7808*10^{-4}*T^2$

Where T = temperature in Kelvin

The quadratic formula for the virial coefficient for air (CO_2-free) was calculated using the old "Sengers et al." data for dry CO_2-free air to formulate a temperature-dependency

equation. A quadratic fit was made to the listed B values for the following temperatures in Kelvin:

273.15 (B = -13.5), 280 (-11.9), and 300 (-7.7).

[Sengers et al., 1971]

We used the Sengers data because Dymond et al. do not give virial coefficients for CO_2-free air. The second virial coefficient for air could alternately have been calculated from the above equations for N_2, O_2, and additionally the equation for Ar, plus the cross virials.

5.3 CO_2 Isotopic Constants.

For the first time in this report, small corrections to Scripps manometric scale resulting from differences in the isotopic composition of manometric reference gases relative to ambient air are considered, as discussed further below. To estimate corrections for isotopic differences we utilize the following constants from Lee et al. [2006] (see also references therein):

Absolute mole ratio of $^{13}C/^{12}C$ in NBS19: $^{13}R_{NBS19} = 0.0112015$

Absolute mole ratio $^{18}O/^{16}O$ of VSMOW: $^{18}R_{VSMOW} = 0.0020052$

$\delta^{13}C$ of NBS19 standard as reported on PDB scale: $\delta^{13}C(NBS19)_{PDB} = 1.95‰$

Constants used in formula to estimate the $^{17}O/^{16}O$ ratio from the $^{18}O/^{16}O$ ratio:

$^{17}R = {}^{18}R^{a} \cdot K$

$a = 0.516$

$K = 0.0099235$

Here ^{17}R and ^{18}R are the $^{17}O/^{16}O$ and $^{18}O/^{16}O$ mole ratios, respectively.

For relation between oxygen isotope references, we use determinations from [Coplen et al., 1983]:

$^{18}R_{PDB}/^{18}R_{VSMOW} = 1.03091$

$^{18}R_{PDB\text{-}CO2}/^{18}R_{PDB} = 1.01025$

6 Determinations of the Small Chamber Volume

The individual calibration volumes of the small, nominally 4 cc, chamber have been revised using temperature and other constant adjustments as described in Section 4 and Section 5 respectively. Plenum volumes (Figure 3), were modeled as varying linearly over time, and the linear fit parameters for each plenum are listed in Table 3.

The small chamber volume is calibrated by transferring into it a known amount of CO_2 and measuring the resultant pressure along with the temperature. The known amount of CO_2 is established by filling plenums, with known volumes V_P, as described above, with pure CO_2 to a known pressure P_P and measured temperature T_P. The number of moles of CO_2 in the plenum n_C, is calculated from the equation of state including virial coefficients for carbon dioxide, B_C:

$$\frac{P_C V_P}{n_C R T_P} = 1 + \frac{n_C B_C}{V_P}$$

The number of moles of CO_2 is then given by:

$$n_C = \frac{V_P}{2B_C} \times \left[1 - \left[1 + \frac{4 P_P B_C}{R T_P} \right]^{1/2} \right]$$

Filling of the plenums from 1974 through 1999 has been described in detail in previous reports [Keeling et al, 2002, p.16-19]. The original data and resulting calculations of moles of CO_2 in the plenum fills from 1974 to 1999 are reported here in Tables A2 and A3.

Beginning in 2005, after the renovation of the manometer room, the procedure for filling of the plenums changed. Previously the plenums were filled to ambient atmospheric pressure with the ambient pressure measured on a wall barometer (Fortin Barometer) and reported in Table A2. Subsequently, the fills were done to a controlled pressure, as measured using a dead-weight gauge made by Ruska Instrument Corporation (gas lubricated piston pressure gage, model 2465-754). This method allowed using plenums of a larger volume because the fill pressure could be less than one atmosphere. Another change initiated at that time was the immediate transfer of CO_2 gas from the plenums to flame-off tubes for storage until use. This change in procedure allowed more convenient and frequent calibrations of the small manometer volume. Transfer of the gas into the 4 cc chamber from either a plenum or a flame-off tube has been done essentially the same way throughout the history of calibrations, again as described in prior reports. Data and resulting CO_2 moles for all plenum fills from 1999 to 2008 using the dead-weight gauge are reported here in Table A3. Only a subset of these fills were used for CMM determinations. We report a description of dead-weight gauge calculations along with Table A3.

Table A4 shows data supporting revised estimates of the CMM 4 cc chamber volumes from all of the calibrations made from 1974 to 2009, including new estimates of plenum fill amounts allowing for drift in plenum volume. The individual determinations of the 4cc volume are presented in Figure 4 as open circles. This figure also shows, as blue filled triangles, the average of individual measured volumes for manometer calibration periods in 1974, 1985, 1988, 1990, 1993 and 1998 as listed in Table 6.3 of the previous manometer report for the X99A scale [Keeling et al., 2002], and as black filled squares, new averages for these same time periods based upon the above corrections. The vertical black solid error bars on these new average volumes indicate the standard deviation of each average.

6.1 Characterization of 4 cc Chamber Drift

Comparing different periods in Figure 4, the mean chamber volume determined here from plenum calibrations conducted in 1974 is 3.7970 cc, which agrees quite well with the value of 3.7974 cc reported previously [Keeling et al., 2002]. This is expected since

both the plenum drift and temperature correction that impact the small chamber volume is at a minimum at this time. This new 1974 value has been assumed to represent the 4cc chamber's volume up to the period of anomalous behavior in 1983 described in Section 1.

The mean chamber volume determined here for the period between 1985 and 1990 is 3.7993 cc. As seen from Figure 4, this value lies slightly below the determinations within this period presented in the 2002 report [Keeling et al., 2002].

As seen in Figure 4, the measurements of the small chamber volume in 1994 and 1999 generally fall below those made before 1991 and after 2005. Since the standard deviations of the calibrations in 1994 and 1999 are about twice those of the 1985 through 1990 data, these data do not appear to have as high integrity. We have therefore excluded these data from calculation of chamber volume.

In November 1984, the manometer was disassembled, cleaned and annealed [Keeling et al., 1986]. At the same time the mercury, which had accumulated a considerable amount of visible oxidation products, was replaced. The black vertical dash/dot line in Figure 4 indicates the time at which the manometer was cleaned.

In April 1999, the mercury in both manometers was removed prior to "boxing" the manometer cabinet for the duration of the old Ritter Hall renovation. The mercury surface did not display a visible "scum" as it had in 1984. The mercury was gold-filtered just prior to refilling the manometer in September – October 2004. The first runs made in early 2005 after this cleaning indicated some instrument drift and those runs have also been excluded from the volume analysis.

Because there is little evidence for any systematic trend, we have assumed that the chamber volume was constant for the entire period 1985 through 2010, with a mean volume of 3.7934 cc. This value is the mean of all unflagged data between 1985 and 2010 with the exception of the three sets of measurements in 1994, 1999 and early 2005. If we include all the 1994 and 1999 readings in this average, then the chamber volume would be reduced to 3.7929 cc. If we exclude all data since 1985 then the volume

reduces to 3.7928 cc. Using these volume averages in place of the specified 3.7934 cc value would tend to decrease CO_2 mole fractions for a 400 ppm gas by about -0.05 and -0.06 ppm respectively. These findings are summarized in Table 4.

One series of primary tank analyses was conducted in 1983, during which the physical condition of the manometer is in question. For this calibration period, mole fractions calculated using a 4 cc chamber volume from either 1974 (3.7970 cc) or since 1985 (3.7935 cc) yield reference gas concentrations that are well outside the range expected for each tank when considering the prior and subsequent calibrations. We have no reason to expect that the primary tanks CO_2 concentration actually shifted anomalously in this period. We have found (by trial and error) that assigning the 4 cc chamber volume to be 3.8000 cc in 1983 yields tank mole fractions that are consistent with measurements made in the previous and following calibration periods of 1980 and 1985 . We thus assign a value of 3.8000 cc for this anomalous period. (Plots of the primary reference gas concentrations that were used to constrain this chamber volume are presented in Figure 12 and Figure 13).

6.2 Previous Analysis of Small Chamber Volume

The assumed 4 cc chamber volume, indicated by the black line in Figure 4, is thus now primarily constrained by direct observations from plenum calibrations, with only the portion representing manometer use in 1983 (when there were documented problems with the instrument) being constrained by prescribing primary reference gas concentrations. This is in marked contrast to the way in which the chamber volume was determined for the X99A scale [Keeling et al., 2002], when the volume was allowed to vary so as to minimize the changes in primary reference gas concentrations. The dashed line in Figure 4 illustrates the previously assumed time variation of the small chamber's volume.

There are three reasons for preferring this revised approach, using direct observations of the plenum volumes, over the previous approach assuming stable reference gas concentrations: First, more recent plenum calibrations performed between 2005 and 2010 suggest that the decrease in chamber volume previously assumed to have occurred

since 1990 (dashed line in Figure 4) is probably not real. Second, the approach gives greater weight to the absolute mole-fraction CO_2 determinations by manometry. Third, experience with long term storage of carbon dioxide reference gases in steel cylinders obtained from the R.F. Keeling lab suggests that these gases do indeed tend to drift upward slowly in carbon dioxide concentration when compared with gases stored in aluminum cylinders. Given the direct relationship between chamber volume and mole fraction, we expect this change to impact derived primary tank concentrations as well as the APC infrared analyzer scale conversions, Section 1.

7 Determinations of the Large Chamber

The volume of the large manometer chamber of the CMM is determined with reference to a "plenum" (numbered P13) having a volume calibrated by weighing contained water. The plenum in this case is a nominally 4-liter flask integral to the CMM, i.e. it is mounted within the CMM cabinet and connected to the rest of the CMM. It had been removed from the cabinet and calibrated for volume in 1974 by A. Adams [1976] by weighing it filled with water. In 2004 P13 was again calibrated for volume, this time with greater precision on a modern balance by G. Emanuele. After applying the weight buoyancy correction to Adams' calibration data, the new calibration was one part in 6600 lower than the earlier calibration. The revised data is included in Table 3 ("Plenum P13"). The apparent drift is displayed in Figure 5. Compared to the small plenums, the change is relatively small as a fraction of the volume, less than 1 part in 4000.

Calibration of the volume of the large manometer chamber is analogous to calibrations of the small chamber, except there is only one plenum and it is part of the CMM so all relative calibration measurements are made with the CMM. Temperature measurements are made with the CMM thermometers, but the effect of the thermometer calibration (see Section 2) "cancels out" in the process. The 4-liter flask is filled with pure CO_2 gas at a measured pressure and temperature, and then the gas is transferred into the 5000 cc chamber, where its pressure and temperature are again measured. In addition to such calibrations in 1974 (three) and in 1980 (two), three more calibrations were made in 2006. Table A5 reports the 4-liter "fill" data and Table A6 the measurements in the 5000

cc chamber determining its volume relative to the 4-liter volume. Figure 6 displays all of the large chamber volume calibrations. We approximate the apparent drift as a linear function of time as shown in Figure 6. The change in volume, including the effects of virials, resulting from this reassessment of the large chamber corresponds to about one part in 5000, equivalent to about 0.08 ppm CO_2 in a reference gas.

8 Calibrations of Cathetometer

The instrument used to measure mercury heights in the CMM is a custom high-precision cathetometer made by the Fred Henson & Co. of Pasadena, CA in 1956. We have carried out calibrations of this instrument several times over the years.

The first calibration occurred in January 2003 during the period of renovation of the laboratory (1999-2004). "Teeth" on a machinist's "Cadillac" gauge were measured with the cathetometer. The teeth were one inch apart (+/- .0001"). Figure 7 is a plot of the results of these measurements, along with the original factory-supplied calibration. An increasing positive error, the cathetometer reading high relative to the gauge, was observed as the measured height increased from 138 mm to 875 mm. The factory calibration was made in 1958 against Johansson "A" gauge blocks. The two calibrations are in reasonably close agreement. The corrections amount to less than a part in 10^4 in pressure with smaller relative impact on CO_2 mole fractions because of compensation from pressure readings on the small and large chambers.

The second calibration exercise was made in April 2006, comparing pressures produced by a gas piston gauge made by Ruska Corporation with those measured in the CMM using the cathetometer. The 2006 calibration measurements (shown in Figure 9) were made on the large manometer only. The results were not very precise because the piston gauge could not be held steady for the relatively long time required to measure the mercury heights with the cathetometer.

The final and most intensive calibrations were made between February and September 2009, again comparing pressures on the gas piston gauge and the CMM. This time the gas piston gauge had been modified with automatic pressure control to allow the

maintenance of precise pressure (Ruska autofloat system, model 2465A-754). Both the large and small manometers were calibrated with eight pressures on each of three separate days. The results are displayed as errors in pressure (in mm of mercury height) as a function of the height of the vacuum columns in both manometers. See Figures 8 and 9 for the small and large manometers, respectively. The large manometer plot also displays the 2006 calibration data, in reasonable agreement with the more precise measurements in 2009.

There is a striking difference between the machinist's gauge calibrations and the gas piston gauge calibrations: the latter indicate the cathetometer measured low relative to the supplied gauge pressures while the former indicate that the cathetometer measured high. The scatter in the gas piston gauge calibration data is very small and the shape of the height dependence is generally similar for the two manometers, although the absolute offsets differ, despite the fact that the offsets would be the same if caused only by the cathetometer error. The offset is larger for the small-chamber manometer than for the large-chamber manometer.

A discrepancy between the cathetometer-determined pressures and the dead-weight determined pressures could occur if the actual density of the mercury density was different than computed by the Tanaka et al. (2001) formula. For the small-volume manometer, a density error of roughly 1 part in 10^4 would be required, or equivalently an error in temperature of order of ~0.4C, allowing for mercury thermal expansion of ~18 parts in 10^4 per degree Celsius) which is too large to be a plausible cause of the discrepancies. We do not understand the reason for the differing offsets, but the implications for the manometric determinations of CO_2 mole fractions is in any case small.

We have investigated the effect of correcting the CMM measurements to the gas piston gauge for the reference gas measurements. The quadratic relationship of the corrections for each manometer was applied to all mercury height measurements, including the manometer chamber volume calibrations and reference gas analyses. Figure 10 plots the resulting corrections as a function of the mole fraction of CO_2 in the reference gases. In

the calibration range of 200 to 500 ppm the indicated correction is between 0.02 and 0.05 ppm.

Since we do not understand the reasons for the differing corrections from the machinist's gauge and from the gas piston gauge, we have elected not to apply the small corrections to any of the data reported here. All data are reported adopting the cathetometer readings without further correction.

9 Isotope Corrections

The CO_2 mole fractions determined by manometry include contributions from all the isotopologues of CO_2. The APC analyzer, on the other hand, presumably effectively responds only to the dominant isotopologue of CO_2, i.e. $^{12}C^{16}O^{16}O$ because it uses a gas-filled detector for wavelength selectivity, with $^{12}C^{16}O^{16}O$ being the dominant isotopologue of the fill gas. This high isotopic selectivity of the APC is supported by the study of Lee et al. (2006) who investigated the isotopic sensitivity of a Siemens Ultramat CO_2 analyzer, which similarly uses a gas-filled detector. If the isotopic composition of the reference gases differs substantially from natural atmospheric CO_2, the difference in isotopic sensitivity of the manometry and the APC could lead to errors in the propagation of the manometric calibration to air measurements.

Following Lee et al, we assess the magnitude of the error based on the ratio ^{44}F, i.e. the ratio of the (molar) abundance of $^{12}C^{16}O^{16}O$ compared to the abundance of all isotopologues. Here $^{12}C^{16}O^{16}O$ is labeled according to its molecular weight, 44 = 12+16+16. If X is the (total) CO_2 mole fraction, then $^{44}F \cdot X$ is the mole fraction of $^{12}C^{16}O^{16}O$. Natural background air has a near-constant value of $^{44}F = 0.984106$ with only very small variations with space and time. (We estimate that the annual mean value ^{44}F at Mauna Loa increased from 0.984101 in 1981 to 0.984109 in 2011). The benchmark value of $^{44}F = 0.984106$ was computed assuming a nominal atmospheric CO_2 isotopic composition of $\delta^{13}C = -8.00$ ‰ and $\delta^{18}O = 0$ ‰ (PDB-CO_2 scale) (see Table 5).

For each manometrically determined mole fraction, X, we compute the isotopically-equivalent mole fraction $X' = (^{44}F/0.984106)X$. Here X' is the mole fraction the sample

would have if its $^{12}C^{16}O^{16}O$ mole fraction (and hence its APC response) were unchanged, but the relative abundance of the rare isotopologues were adjusted to be in natural proportions.

Calibrating the APC using X' rather than X values corrects for differences in the isotopic composition of the reference gases and yields values for secondary reference gases and air samples analyzed on the APC analyzer on a consistent isotopically-equivalent basis. For air samples, this isotopically-equivalent basis is an appropriate basis for reporting true atmospheric mole fractions subject only to very minor errors from neglecting variations in ^{44}F in background air. For secondary reference gases analyzed at Scripps for other CO_2 programs, further isotopic corrections may be needed depending on the isotopic response of the analyzers used by those programs. The analyses at Scripps can be viewed as providing an absolute determination of the $^{12}C^{16}O^{16}O$ mole fraction divided by 0.984106.

To compute isotopic corrections, we rely on isotopic analyses carried out on the Scripps manometric reference gases using standard procedures (Bollenbacher et al., 2000). A summary of these measurements and the corresponding isotopic corrections is shown in Table 5. The calculations follow methods described in Lee et al. [2006]. The differences X'− X are uniformly less than 0.06 ppm, i.e. almost negligible in the context of other errors. However, because they are systematic rather than random we have proceeded to apply corrections for these small isotopic effects.

10 CMM Accuracy and Imprecision

The accuracy of the CMM is mainly limited by the determination of the 4cc chamber volume which is tied to the plenum determinations. The most important known source of uncertainty is related to the imprecise positioning of the mercury column at the pointer that marks the end of the chamber. Precise positioning is required to ensure that the chamber volume is consistently defined during chamber volume measurements and that identical CO_2 volumes are trapped in the chamber for each mole fraction measurement as well as for the chamber volume measurement experiments.

It is estimated that the repeatability of the pointer positioning is approximately ±0.015 mm, which, for a chamber diameter at the pointer of 0.95 cm corresponds to a volume uncertainty of ±0.0011 cm^3 or roughly one part in 1 part in 4000. This is similar to the scatter of the retained points in Figure 4. However, since the small chamber volume that is used in mole fraction calculation is determined from an average of many individual volume readings, the uncertainty in the average, used for the calculations, may be smaller. On the other hand, the volume itself may be different in different periods, such that the precision of the long-term average may not be appropriate for assessing systematic error in any given period. Judging from the shifts that occurred when the mercury was cleaned in 1984 and the more scattered and lower readings in 1994 and 1999 (Figure 4), it seems possible that there are systematic errors in some periods as large as part in 1500.

The impact of uncertainty in the large 5 liter chamber volume is clearly much smaller than that of the 4cc volume. Weighing inaccuracies in determination of the plenum (P13) used to determine the large volume are less than a part in 10000, as is the reproducibility of multiple determinations (Figure 5). The reproducibility of the determinations of the large volume using this plenum is also roughly a part in 10000 (Figure 6).

The impact of uncertainty in the pressure measurement (via column heights) and temperature measurements are also relatively small. Both of these are accurate to roughly a part in 10000 or better. The relative error in the manometric determinations from presure and temperature inaccuracy is even smaller, because the systematic errors in the small volume determination and systematic errors in normal manometer determinations partly cancel.

Our best indicator of the precision of manometric determinations is based on repeated analysis of a particular test cylinder from Sept. 2005 to Feb. 2010. The gas was CO_2-in-air, contained in aluminum cylinder No. 1661, with a history of stability according to APC measurements. During the four years and four months duration of the experiment, a total of 32 measurements of the gas were made. The procedures followed for the CMM

analyses were identical to those used to analyze the primary reference gases [Manometer Report III, Guenther and Keeling, 1981].

Figure 11 is a plot of the data versus time. Using the averaged small volume determination yields one point per analysis date. A linear fit indicates a downward drift of about 0.08 ppm over the period relative to the long-term mean, although it is not clearly significant given the scatter. The standard deviation of the individual points relative to their long-term mean (not the line) is ± 0.096 ppm or about one in 4000, which is quite similar to our uncertainty estimate listed in Section 9. [The CO_2 extract for the measurement was always measured at least twice and occasionally more often in the small manometer and the total gas once in the large manometer.] Looking only at replicate measurements of the CO_2 fraction on the same day yields a standard deviation of ± 0.049 ppm, or one part in 7700. This was calculated using the standard formula for the pooled standard deviation [Keeling et al, Appendix A2, 2002].

11 Primary Reference Gas Determination

Using the assumed variations of the large and small chambers volumes, indicated by the solid black lines shown in Figure 4 and Figure 6, we have recalculated carbon dioxide concentrations for all gases analyzed on the CMM. The method used to determine gas pressure and carbon dioxide mole fraction is identical to that used previously [Keeling et al., 2002]. A list of all derived reference gas concentrations is included with the manometer data listed in Table A7.

These mole fractions for nitrogen and air primary reference gases are also illustrated in Figure 12 and Figure 13 respectively. These figures show the *deviation* in each gas's measured concentration from its time-averaged value, with the time-averaged concentration shown in the figure legend adjacent to the ID number. Filled symbols represent the individual determinations and open symbols show flagged data.

These figures also show straight linear fits through the data that are used to interpolate the reference gas concentrations in time and to obtain reference gas mole fractions during APC calibrations, see Section 12 below.

The black dashed vertical lines in these figures indicates the date on which the manometer was cleaned, immediately prior to which the "anomalous" small chamber volume was assumed to occur as described in Section 6.1. The small chamber volume in 1983 was fixed at 3.8000 cc, as discussed above, so that the individual gases drifted in a manner consistent with calibrations performed in 1980 and 1985.

With a few exceptions, the behavior of the primary reference gases over time shows certain characteristics that are consistent from gas-to-gas. Generally speaking, after an initial settling-in period, the carbon dioxide concentration within each reference gas tends to drift upward slightly over time. Gases close to ambient concentration generally drift upward by about 0.2 ppm per decade, but with considerable tank-to-tank differences, and not all trends being significant. This is in contrast to previous analysis in which, on average, primaries were fixed to be stable to within a few hundredths over a decade (see Figure 5 of Keeling et al. [2002]).

12 Infrared Analyzer Calibrations

On a day-to-day basis, carbon dioxide concentrations of reference gases and flask samples are measured at Scripps on the APC non-dispersive infrared analyzer. The response of this analyzer is related in a non-linear way to the carbon dioxide mole fraction of the sample, and this non-linear relationship has been characterized by a cubic function.

12.1 APC Linear *I* and *J* Scales

In order to precisely characterize the non-linear response, the nitrogen and air primary cylinders have been run on the APC during certain APC marathon calibration periods that are spaced several years apart. During these APC calibration periods, two standard reference gases are analyzed to determine the instrument's response on a linear *I* concentration scale. This determines the instrument's sensitivity or recorder scale factor, RSF. Each of the air and/or nitrogen primary reference gases is then run on the APC alternating with a transfer gas or working tank cylinder to correct for short-term "baseline" instrument drift.

Primary reference gas values are initially reported on the linear APC *I* scale, which is then adjusted to a second linear *J* scale that is closer to true ppm. The linear *I* and *J* scales are related by the following equation:

$$J = 1.2186(I - 311.51) + 311.51$$

For each APC calibration period, the non-linear relationship of the APC has been characterized by performing a cubic fit of the manometrically determined mole fractions *X* expressed as a function of the APC *J* values for each reference gas.

$$X = a0 + a1J + a2J^2 + a3J^3$$

This allows determination of sets of cubic coefficients a0, a1, a2 and a3 for nitrogen and air primaries for each APC calibration period via an over-constrained least squares fitting technique. With these fit coefficients identified for each APC calibration period, we have calculated APC approximations of the reference gas's carbon dioxide mole fraction X_A for each measured *J* value as well as the residual *r* between the manometric and APC *X* values:

$$r = X - X_A$$

For APC calibration periods between 1985 and 1999, the J values used in these fits have been taken directly from the "Average *J*" column, Table 9.3 of Keeling et al., 2002. For APC calibration periods since 1999 we have used the same methodology as described in that report to obtain average *J* values for each of the APC calibration periods in 2001, 2003, 2005, 2008 and 2012. Average *J* values used for all APC calibration periods for nitrogen and air are listed in Table 6 and Table 7 respectively.

The time-varying manometric primary reference gas concentrations *X* used in these fits have been extracted from the linear fits through the observed manometric concentrations shown in Figure 12 and Figure 13. Since the last manometric determinations were made in 2005, we have (for now) kept the *X* values fixed at the 2005 values for scale calculations in 2008 and 2012. This will likely be revisited as further information on tank

drift is obtained in recent years, but has no bearing on the comparison with NOAA tanks which were all made before year 2006.

In Appendix B (Figure B1-B24) we include `figures of all APC fit data. On the left axis these plots show *X* concentrations. On the right axis these plots show the fit residual *r* as a function of the APC *J* value for each of the calibration periods 1985, 1987, 1989, 1990, 1993, 1995, 1997, 1999, 2001, 2003, 2005, 2008 and 2012.

The APC residual *r* is also presented as a function of time for each primary reference gas in Figure 14 and Figure 15. Since we expect that all the gases should behave in a consistent manner over time when analyzed on either the manometer or APC, a large residual for any reference gas and time would indicate a problem with either the APC or manometric analysis.

12.2 Implementation of the New X12 Calibration Scale

Historically, the *J-X* cubic corrections, used to assign mole fractions from measured J values, are incorporated into the APC workup procedures via a series of FORTRAN functions collectively known as "cal services". Included in this group are 2 functions *aircubicsXXX.f* and *n2cubicsXXX.f*, where *XXX* is an abbreviation of the scale name, that perform cubic adjustment between *J* and *X* scales. For example, *aircubics08A.f* is the FORTRAN code defining the *J-X* cubic conversion parameters used for the X08A calibration scale.

For each APC measurement these functions calculate cubic corrections using polynomial coefficients from APC calibration dates immediately before and after the date of the measurement. The *X* value is then determined as a linear interpolation in time between these two bracketing points.

For data recorded since 1985, conversion from *J* to *X* scale has always been carried out directly within *aircubicsXXX.f* and *n2cubicsXXX.f*, without any additional or preceding conversion factors being required. For these data it has been possible to modify the two FORTRAN cubic functions, incorporating the new coefficients for each APC calibration

date as listed on Appendix B (Figures B1- B24). These cubic coefficients are now included in the FORTRAN codes *aircubics12.f* and *n2cubics12.f*.

However, for data recorded *before* 1985 a number of correction factors had been previously applied to the J values prior to applying the *J-X* cubic adjustment. These *J* value adjustments combined corrections to both the manometric and APC determinations of primary reference gases. They were implemented sequentially in FORTRAN codes named *corr1.f*, *corr2.f*, *corr3.f*, *corr4.f* and *corr5.f*.

In principle, the plenum drift can impact data back to 1974 (the first year that plenum calibrations were implemented), while drift in the thermometers and changes in other constants can impact data back to the beginning of the records. The effect of these changes before 1983 is very small, however. In 1983, the average difference between the newer scale and the previous scale would be only 0.02 ppm and would be even smaller before that. To recalculate the full set of corrections before 1985 is complicated, however, by the need to revisit the basis of correction factors (*corr1.f* etc.). Because the net effect would ultimately involve changes of order 0.02 ppm or smaller, we have instead adopted a post-hoc linear interpolation method to revise the data before 1985. These are implemented as two steps:

1) For data between 1968 and 1983, the APC X values are increased linearly over time with a 0 ppm correction in 1968 and a 0.02 ppm correction in 1983.
2) For data between 1983 and 1985, APC X values are calculated by linearly interpolating in time between the corrected 1983 and 1985 values described above.

These adjustments are incorporated into a new correction routine *corr6.f*.

Comparison of the X12 and X08A APC scales for nitrogen and air are presented in Figure 16 and Figure 17. Differences between the scales through 2008 can be explained by the differing manner in which the small chamber volume has been modeled in this and in the X08A scale analyses. For the X08A scale, the small chamber volume was assumed to decrease from 1985 to 1997 and was held constant thereafter. The small chamber volume derived in this analysis is smaller than that used for X08A up to 1996 and has

exceeded it since that time. The relative change in small chamber volume match closely the scale differences through 2008.

In 2012 an additional marathon APC calibration day was conducted that revealed a change in the primaries responses on that instrument. In general such a change can be tied solely to the functioning of the APC and its span gas behavior, and may not be a consequence of primary gas changes. These new APC values mean that cubics calculated in 2012 are based upon both changed manometric *X* and APC *I* values, so that the total scale change is relatively large. This is a normal characteristic of calibration scale changes on the APC.

13 Comparisons with the NOAA Calibration Scale

To help evaluate the transition of the CCL function from SIO to NOAA in 1995, two suites of CO_2 in air calibration gases were exchanged between NOAA and SIO. The original suite consisted of 15 tanks, analyzed at SIO on the APC analyzer between 1992 and 1999. Eight of this set of 15 were also analyzed manometrically at SIO in 1999. These tanks became the primary CO_2 standards for NOAA and were subjected to repeated manometric determinations at NOAA, starting in 1996 and continuing to the present (Zhao and Tans, 2006). The second suite consisted of nine tanks that were analyzed both manometrically and the infrared analysis systems at SIO in 2005 and subject to repeated infrared and manometric analyses at NOAA, mostly between 2004 and 2010. The summary of the NOAA readings were communicated by Pieter Tans of NOAA (in Emails sent to R. Keeling in March 2016).

Results from the original suite of 15 tanks are presented in Table 8 and Figure 18. These comparisons are based on 10 separate manometric runs at NOAA from 1996 through 2015. Each run comprised 3 to 4 separate manometric measurements per tank. Only one of these tanks (103) showed evidence of significant drift, based on the NOAA manometric determinations. For all other tanks, we compare the determinations at SIO to the averages of the NOAA manometric determinations. For tank 103, we compare to a linear model of the drift provided to us by NOAA (see table caption). The manometric results from this suite were presented previously in Guenther and Keeling (2000), where

it was noted that the manometric determinations for tank103 had about twice the normal dispersion, which justified neglecting the manometric determinations of this tank. Disregarding Gas 103, Guenther and Keeling reported an average offset between SIO results and the CMDL results of −0.17 ppm, i.e. SIO values were lower than NOAA by 0.17 ppm. With the revised analysis supporting the X12 scale, as well as updated values from NOAA, we now find an average SIO-NOAA offset of −0.09 ppm for these determinations, with a standard deviation (of individual cylinder offsets) of ±0.12 ppm.

The APC analyses on the original suite of 15 tanks were described in Guenther et al. (2002b). All 15 tanks were analyzed 5 times, in 1992, 1993, 1996, 1997, and 1999. Focusing on the six cylinders with concentrations between 350 and 400 ppm, and using revised values from NOAA and SIO, we find averages offsets of −0.20, 0.01, −0.05, +0.03, −0.17 ppm in these five years, respectively. The overall average of these five averages is −0.08 ppm with a standard deviation (of each yearly average) of ±0.10 ppm.

Results from the second suite of nine tanks are presented in Table 9 and Figure 19. Repeated analyses at NOAA show that all of these tanks except one (17491) appear stable over time. For the other tanks, we based the comparison on the average of the NOAA readings. For tank 17491, we use an estimate of linear drift to interpolate to year 2005. This suite includes two cylinders with concentrations above 450 ppm, higher than any manometric analyses done with the 1992 suite. These higher cylinders show larger systematic offsets between SIO and NOAA compared to the tanks closer to the ambient concentration range. Including only the seven cylinders with concentrations below 450 ppm, and based on the manometric workup supporting the X12 scale, we find an average SIO-NOAA offset of −0.01 ppm, with a standard deviation (of individual cylinder offsets) of ± 0.06 ppm. A similar comparison of these seven tanks using instead the APC values from SIO yields an average SIO-NOAA offset of −0.05 ppm, with a standard deviation ±0.06 ppm. If the APC-based comparison is further restricted to including only the four cylinders in the 350 to 450 ppm range, we find an average offset of −0.03 ppm and a standard deviation of ±0.05 ppm.

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15 Tables

Table 1: Meniscus corrections measured on the small manometer. Meniscus correction MnCor (in mm) measured on given Date is an additive correction to the column height.

Date	MnCor	Date	MnCor	Date	MnCor	Date	MnCor
1969-11-27	-0.430	1976-09-09	-0.394	1984-01-26	-0.418	1990-05-30	-0.312
1969-12-08	-0.411	1976-09-27	-0.368	1984-01-26	-0.394	1990-10-02	-0.314
1969-12-12	-0.363	1977-08-30	-0.322	1984-01-26	-0.428	1992-02-12	-0.276
1970-03-09	-0.359	1977-12-28	-0.255	1984-01-26	-0.410	1992-02-13	-0.291
1970-03-13	-0.409	1978-10-10	-0.333	1984-04-27	-0.378	1993-06-11	-0.310
1970-04-22	-0.409	1978-11-27	-0.345	1984-04-27	-0.352	1995-09-05	-0.266
1970-04-23	-0.276	1979-04-07	-0.370	1984-09-13	-0.384	1995-09-15	-0.286
1970-04-23	-0.346	1979-07-23	-0.304	1984-11-07	-0.424	1998-01-23	-0.207
1970-04-27	-0.272	1980-01-22	-0.350	1984-12-05	-0.310	1998-11-13	-0.210
1970-04-27	-0.321	1980-04-24	-0.346	1984-12-06	-0.397	1999-03-05	-0.228
1970-04-29	-0.322	1980-09-04	-0.344	1984-12-07	-0.368	1999-04-21	-0.306
1970-04-30	-0.355	1981-01-30	-0.374	1985-01-31	-0.292	2004-10-27	-0.254
1970-05-06	-0.410	1981-05-18	-0.358	1985-02-07	-0.340	2005-01-14	-0.297
1970-05-18	-0.477	1981-08-04	-0.351	1985-07-01	-0.321	2005-02-01	-0.255
1972-09-08	-0.432	1981-08-12	-0.361	1985-08-26	-0.275	2005-03-28	-0.267
1972-11-21	-0.369	1981-09-11	-0.339	1985-08-26	-0.374	2005-09-17	-0.218
1972-11-21	-0.353	1981-09-14	-0.346	1986-01-13	-0.250	2006-01-13	-0.276
1974-01-02	-0.341	1981-12-28	-0.373	1986-01-13	-0.280	2006-01-13	-0.262
1974-02-22	-0.344	1982-03-08	-0.347	1986-01-14	-0.308	2006-08-24	-0.269
1974-05-31	-0.296	1982-04-19	-0.368	1986-01-14	-0.322	2007-03-06	-0.275
1974-05-31	-0.351	1982-07-26	-0.365	1986-01-14	-0.344	2008-01-14	-0.314
1974-06-28	-0.381	1982-11-02	-0.371	1987-03-24	-0.234	2008-08-19	-0.282
1974-10-17	-0.391	1983-03-10	-0.343	1987-03-26	-0.327	2009-07-08	-0.279
1975-05-08	-0.318	1983-06-24	-0.368	1987-03-26	-0.350	2009-08-28	-0.272
1975-09-08	-0.352	1983-08-16	-0.381	1987-03-26	-0.268		
1975-11-07	-0.392	1983-11-02	-0.397	1988-02-29	-0.295		
1976-04-06	-0.376	1984-01-26	-0.382	1988-03-01	-0.294		

Table 2: Meniscus corrections measured on the large manometer. Meniscus correction MnCor (in mm) measured on given Date is an additive correction to the column height.

Date	MnCor	Date	MnCor	Date	MnCor	Date	MnCor
1969-12-08	-0.036	1974-08-14	-0.128	1985-01-31	-0.005	1998-11-13	-0.063
1969-12-12	-0.026	1974-10-17	-0.142	1985-07-01	+0.007	1998-11-13	-0.055
1970-03-09	-0.127	1979-09-14	+0.014	1987-03-27	-0.006	1999-03-05	-0.027
1970-03-13	-0.126	1980-04-24	-0.010	1988-03-07	+0.052	1999-04-21	+0.004
1970-04-22	-0.104	1980-09-04	-0.015	1990-05-29	-0.018	2005-01-03	+0.112
1970-05-06	-0.014	1981-08-04	-0.066	1990-10-02	+0.006	2005-05-02	+0.138
1970-05-15	+0.015	1981-09-11	-0.050	1992-02-12	+0.017	2006-02-24	+0.073
1972-09-08	+0.026	1982-04-19	-0.002	1992-02-13	-0.021	2007-03-06	+0.149
1972-11-21	+0.010	1982-11-02	+0.044	1993-06-18	+0.083	2008-04-23	+0.143
1974-01-02	-0.111	1983-08-16	+0.036	1995-09-18	-0.006	2009-02-19	+0.157
1974-02-22	-0.121	1983-11-02	-0.012	1995-11-07	-0.045	2009-09-02	+0.171
1974-05-31	-0.068	1984-10-29	+0.009	1997-12-29	-0.009		

Table 3: Parameters used to approximate measured plenum and inferred chamber volumes variation with time. Volume drift is expressed as a constant (Constant) and linear rate of change (Rate) for specific time windows defined by T-Start and T-End. Volume at time T is calculated as Volume = Constant + Rate*(T - T-Start)

Name	Volume Type	T-Start	T-End	Constant cc	Rate cc/day
Small	Chamber	1969-01-01	1982-01-01	3.7970	--
Small	Chamber	1982-01-01	1985-01-01	3.7993	--
Small	Chamber	1985-01-01	--	3.7934	--
Large	Chamber	1969-01-01	--	4991.1	+3.1989e-05
64	Plenum	1969-01-01	--	66.543	-4.4280e-06
L02	Plenum	1969-01-01	--	11.159	-8.6182e-08
L03	Plenum	1969-01-01	--	12.652	--
L04	Plenum	1969-01-01	--	13.681	--
L05	Plenum	1969-01-01	--	16.235	--
L06	Plenum	1969-01-01	--	16.274	--
L07	Plenum	1969-01-01	--	18.292	--
L08	Plenum	1969-01-01	--	20.034	--
P01	Plenum	1969-01-01	--	1.3697	-9.9598e-08
P02	Plenum	1969-01-01	--	1.5295	-9.3663e-08
P03	Plenum	1969-01-01	--	1.7194	-1.1569e-07
P04	Plenum	1969-01-01	--	1.9813	-3.2668e-07
P05	Plenum	1969-01-01	--	2.0429	-2.8697e-07
P06	Plenum	1969-01-01	--	2.1373	-1.3955e-07
P07	Plenum	1969-01-01	--	2.3773	-1.4426e-07
P08	Plenum	1969-01-01	--	2.8010	--
P09	Plenum	1969-01-01	--	52.715	-1.7463e-06
P10	Plenum	1969-01-01	--	1.6924	--
P11	Plenum	1969-01-01	--	278.42	-1.0548e-05
P12	Plenum	1969-01-01	--	1011.1	--
P13	Plenum	1969-01-01	--	3976.0	-4.1113e-05
P14	Plenum	1969-01-01	--	5422.7	-4.7775e-05
P15	Plenum	1969-01-01	--	5223.1	--
P16	Plenum	1969-01-01	--	5314.2	--
P17	Plenum	1969-01-01	--	5319.3	--
P18	Plenum	1969-01-01	--	5349.3	--
P19	Plenum	1969-01-01	--	5236.4	--
P20	Plenum	1969-01-01	--	5329.0	--
P21	Plenum	1969-01-01	--	5079.8	--

Table 4: Summary of small chamber volume averages for measurements since 1985. Standard case excludes measurements made in 1994 and 1999 as well as in early 2005. Other cases considered exclude only the early 2005 data and include all data since 1985. Table compares volumes for the three data groups and shows an estimate of the impact of using each alternate volume on mole fraction for a gas of 400 ppm CO_2.

	Data Since 1985 Included/Excluded	Average Volume	Difference	Standard Error	Concentration Impact @400 ppm
Excl.	1994, 1999 and early 2005	3.7934 cc	-	0.0001 cc	-
	Excl. early 2005	3.7929 cc	0.0005 cc	0.0001 cc	-0.05 ppm
Incl.	All Data Since 1985	3.7928 cc	0.0006 cc	0.0001 cc	-0.06 ppm

Table 5: Isotopic corrections to manometric reference gases.

Tank ID	X‡	$\delta^{13}C_{PDB}$	$\delta^{18}O_{PDB-CO2}$	^{44}F†	$^{44}F/0.984106$	X'	$X'-X$
natural air	365.00	-8.000	0.000	0.984106	1.000000	365.0000	0.000000
71251	214.23	-8.296	-3.420	0.984125	1.000020	214.2341	0.004064
34819	252.91	-8.528	-5.743	0.984138	1.000034	252.9181	0.008143
71286	297.10	-7.783	-4.226	0.984123	1.000018	297.1050	0.005050
71341	322.29	-8.645	-10.109	0.984159	1.000055	322.3073	0.017255
66638	338.81	-8.026	-4.548	0.984127	1.000023	338.8172	0.007170
66625	344.86	-7.603	-3.794	0.984119	1.000014	344.8645	0.004491
66696	360.54	-7.589	-3.778	0.984119	1.000014	360.5446	0.004613
71308	376.11	-8.197	-7.986	0.984144	1.000040	376.1246	0.014607
71370	406.49	-9.933	-10.113	0.984173	1.000069	406.5176	0.027559
71479	453.13	-12.371	-9.813	0.984198	1.000095	453.1723	0.042314
67615	503.46	-14.336	-12.412	0.984231	1.000128	503.5240	0.063963

‡Nominal mole fractions

†^{44}F was computed using the following relations (see Lee et al. 2006 for symbol definitions):

^{13}R=0.0111797 (1+$\delta^{13}C_{PDB}$/1000)

^{12}F=1/(1+^{13}R)

$\delta^{18}O_{VSMOW}$=1.04148 · $\delta^{18}O_{PDB-CO2}$+41.48

^{18}R=0.0020052 (1+$\delta^{18}O_{VSMOW}$/1000)

^{17}R=0.0099235 · $(^{18}R)^{0.516}$

^{16}F=1/(1+^{18}R+^{17}R)

$^{44}F = (^{12}F)\cdot(^{16}F)^2$

Here

0.0111797=0.0112015/(1+1.95/1000)=$^{13}R_{PDB}$=$^{13}R_{NBS19}$/(1+$\delta^{13}C(NBS19)_{PDB}$/1000)

1.04148=(1.01025)(1.03091)=($^{18}R_{PDB}$/$^{18}R_{VSMOW}$)($^{18}R_{PDB-CO2}$/$^{18}R_{PDB}$)

0.0020052=$^{18}R_{VSMOW}$

Table 6: Average APC J Values for Nitrogen Primaries Run During "Marathon Tank Day" Calibration Periods

ID	1970	1974	1980	1983	1985*	1987	1989	1990	1993	1995	1997	1999	2001	2003	2005
2408	-	181.520	-	175.260	175.366	175.102	175.512	176.021	178.107	176.582	175.670	176.046	177.445	176.270	176.800
4274	-	-	-	-	-	-	-	-	236.208	235.472	234.933	235.150	235.855	235.240	235.510
3753	-	241.530	238.930	238.100	238.238	238.182	238.294	238.708	239.844	-	-	-	-	-	-
7366	276.570	275.710	273.840	273.220	273.293	273.214	273.214	273.448	274.001	273.485	273.158	273.268	273.641	273.200	273.380
6078	310.950	311.180	310.230	309.720	309.768	309.663	309.616	309.716	309.848	309.560	309.343	309.446	309.529	-	-
6071	-	-	-	352.800	-	-	-	-	309.146	308.914	308.797	308.953	309.146	308.960	309.020
4296	-	-	-	327.410	-	-	-	-	319.387	319.168	319.080	319.212	319.273	319.190	319.220
2399	324.190	324.250	323.530	323.070	323.104	323.001	322.958	323.026	322.948	322.733	322.514	322.638	322.619	-	-
39239	-	-	332.240	331.690	331.712	331.571	331.519	331.549	331.373	331.183	330.993	331.061	331.115	331.000	330.960
10069	355.640	354.440	-	-	-	-	-	-	-	-	-	-	-	-	-
39272	-	-	-	358.190	358.253	358.034	357.983	357.853	357.424	357.225	357.071	357.095	357.052	357.020	357.020
1540	-	-	377.070	376.460	376.498	376.225	376.208	375.979	375.340	375.162	374.999	374.984	374.894	374.890	374.920
35299	-	406.320	407.190	406.300	406.295	405.995	405.930	405.586	404.606	404.411	404.350	404.209	404.165	404.040	404.100
35316	-	452.220	453.980	452.530	452.471	452.032	451.915	451.400	449.780	449.538	449.534	449.202	449.241	449.030	449.190

* Adjustment for drift in secondary standard 34850, see Keeling et al.[1986], p4

Table 7: Average APC J Values for Air Primaries Run During "Marathon Tank Day" Calibration Periods

ID	1983	1985*	1987	1989	1990	1993	1995	1997	1999	2001	2003	2005	2008	2012
71251	194.510	194.625	194.451	194.666	195.148	196.879	195.638	194.768	195.070	196.087	195.250	195.610	194.030	194.370
34819	241.910	242.140	242.086	242.120	242.508	243.410	242.822	242.340	242.425	243.042	242.560	242.780	241.820	242.070
71286	291.480	291.559	291.459	291.388	291.557	291.839	291.508	291.174	291.325	291.425	291.180	291.280	290.750	290.870
71341	317.510	317.479	317.306	317.208	317.293	317.247	317.016	316.811	316.854	316.865	316.780	316.780	316.390	316.490
66638	333.190	333.250	333.143	333.128	333.123	332.923	332.818	332.575	332.684	332.687	332.630	332.650	332.360	332.390
66625	339.260	339.277	339.116	339.075	339.087	338.765	338.646	338.368	338.458	338.368	338.330	338.350	338.090	338.050
66696	353.610	353.720	353.564	353.535	353.466	353.047	352.947	352.735	352.808	352.721	352.770	352.740	352.590	352.560
71308	368.320	368.353	368.068	368.004	367.829	367.176	367.022	366.825	366.839	366.691	366.690	366.710	366.550	366.510
71370	394.480	394.516	394.324	394.275	393.970	393.105	392.898	392.771	392.725	392.591	392.570	392.600	392.570	392.500
71479	432.640	432.676	432.322	432.237	431.810	430.401	430.243	430.126	429.892	429.853	429.670	429.860	429.820	429.580
67615	470.250	470.279	469.850	469.809	469.272	467.337	467.106	467.206	466.796	466.874	466.650	466.840	466.760	466.470

* Adjustment for drift in secondary standard 34850, see Keeling et al.[1986], p4

Table 8: Concentration comparisons for NOAA tanks analyzed at Scripps in 1992 through 1999

Tank ID	Identification number of NOAA tank. Tanks 136 and 132 are shown with a * as Scripps posesses tanks with the same ID numbers.
NOAA Mano	NOAA's CO_2 concentration based upon measurements with their manometric system.
X12-1992	Scripps CO_2 concentration based upon measurements made in 1992 with the APC analyzer on the X12 calibration scale
Diff 1992	Difference between X12-1992 and NOAA Mano.
X12-1993	Scripps CO_2 concentration based upon measurements made in 1993 with the APC analyzer on the X12 calibration scale
Diff 1993	Difference between X12-1993 and NOAA Mano.
X12-1996	Scripps CO_2 concentration based upon measurements made in 1996 with the APC analyzer on the X12 calibration scale
Diff 1996	Difference between X12-1996 and NOAA Mano.
X12-1997	Scripps CO_2 concentration based upon measurements made in 1997 with the APC analyzer on the X12 calibration scale
Diff 1997	Difference between X12-1997 and NOAA Mano.
X12-1999	Scripps CO_2 concentration based upon measurements made in 1999 with the APC analyzer on the X12 calibration scale
Diff 1999	Difference between X12-1999 and NOAA Mano.
SIO Mano	Scripps CO_2 concentration based upon measurements with the manometric system.
Diff Mano	Difference between SIO Mano and NOAA Mano.

† Cylinder 103 was determined by NOAA to drift downwards in CO_2 at a rate of 0.013 ppm/yr. NOAA values used in this table for cylinder 103 comparisons have been adjusted linearly over time from 353.34 ppm in 1996

Tank ID	NOAA Mano	X12-1992	Diff 1992	X12-1993	Diff 1993	X12-1996	Diff 1996	X12 1997	Diff 1997	X12-1999	Diff 1999	SIO Mano	Diff Mano
110	246.64	246.59	-0.05	246.50	-0.14	246.39	-0.25	246.58	-0.06	247.37	+0.73	246.50	-0.14
102	304.36	304.36	+0.01	304.22	-0.14	304.30	-0.05	304.27	-0.09	304.46	+0.11	-	-
111	324.01	323.95	-0.06	324.01	+0.01	323.94	-0.06	323.99	-0.02	324.04	+0.03	323.91	-0.10
130	337.28	337.22	-0.07	337.24	-0.05	337.27	-0.01	337.26	-0.02	337.29	+0.00	-	-
121	349.38	349.26	-0.12	349.35	-0.03	349.38	-0.01	349.38	-0.00	349.35	-0.04	-	-
103†	353.34	353.10	-0.29	353.18	-0.20	353.22	-0.12	353.21	-0.11	353.17	-0.13	352.78	-0.52
139	360.90	360.71	-0.19	360.86	-0.05	360.90	-0.01	360.92	+0.02	360.82	-0.08	360.76	-0.14
105	369.38	369.24	-0.14	369.41	+0.03	369.37	-0.00	369.48	+0.10	369.26	-0.12	369.38	+0.00
136*	381.33	381.17	-0.16	381.37	+0.03	381.27	-0.06	381.42	+0.09	381.18	-0.15	381.37	+0.04
146	389.60	389.39	-0.21	389.67	+0.07	389.62	+0.01	389.65	+0.05	389.36	-0.25	-	-
101	396.32	396.12	-0.20	396.39	+0.07	396.23	-0.09	396.35	+0.03	396.06	-0.27	396.01	-0.32
106	412.05	411.77	-0.28	412.27	+0.21	412.08	+0.03	412.16	+0.11	411.89	-0.16	-	-
123	423.08	422.69	-0.39	423.27	+0.18	422.98	-0.10	423.11	+0.03	422.92	-0.17	-	-
107	453.03	452.48	-0.55	453.15	+0.12	452.91	-0.12	453.07	+0.04	452.95	-0.08	453.05	+0.02
132*	521.42	520.30	-1.12	521.62	+0.20	521.17	-0.25	521.54	+0.12	521.71	+0.29	-	-

Table 9: Concentration comparisons for NOAA tanks analyzed at Scripps in 2005.

Tank ID	Identification number of NOAA tank.
NOAA IR	NOAA's CO_2 concentration based upon measurements with their Infra Red analyzer.
NOAA Mano	NOAA's CO_2 concentration based upon measurements with their manometric system.
X12-2005	Scripps CO_2 concentration based upon measurements with the APC analyzer on the X12 calibration scale
Diff 2005	Difference between X12-2005 and NOAA Mano.
SIO Mano	Scripps CO_2 concentration based upon measurements with the manometric system.
Diff Mano	Difference between SIO Mano and NOAA Mano.

† Cylinder 17491 was determined by NOAA to drift downwards in CO_2. We have interpolated this drift in time, estimating NOAA's manometric value for this cylinder as 402.40 ppm in 2005

Tank ID	NOAA IR	NOAA Mano	X12-2005	Diff 2005	SIO Mano	Diff Mano
17476	348.38	348.36	348.30	-0.06	348.34	-0.02
18067	352.20	352.18	352.11	-0.07	352.12	-0.06
18470	361.74	361.73	361.75	0.02	361.71	-0.02
18372	375.78	375.77	375.80	0.03	375.82	0.05
17563	388.46	388.46	388.42	-0.04	388.51	0.05
†17491	402.29	402.40	402.32	-0.08	402.38	-0.02
20737	427.65	427.65	427.66	0.01	427.76	0.11
17440	479.52	479.51	479.82	0.31	479.59	0.08
17438	550.30	550.14	550.89	0.75	550.50	0.36

16 Figures

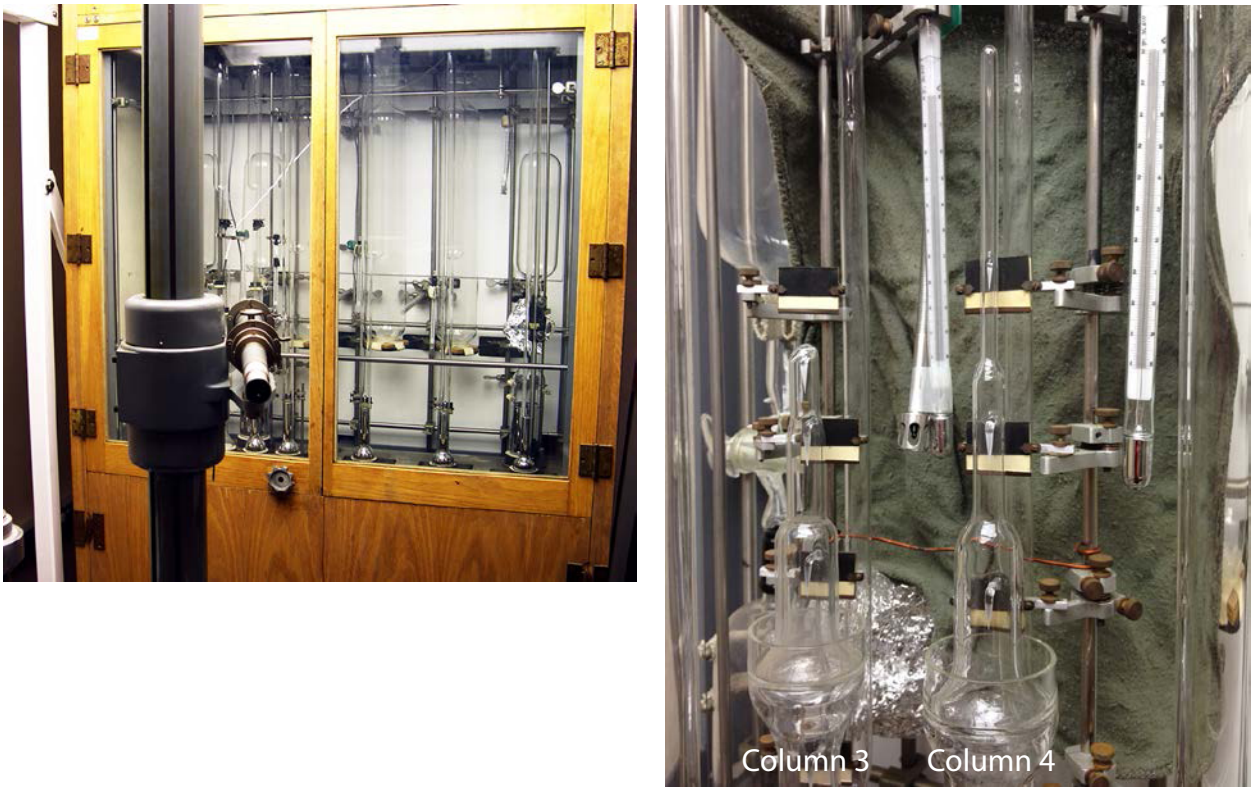


Figure 1: Photographs of the Constant Volume Manometer taken in 2015. Left: Manometer cabinet as seen from behind the cathetometer. Right: Close-up of the primary sample column (Column 4), equipped with pointers (resembling icicles), to enclose different volumes. The 4cc volume is demarked by the pointer closest to the bulb of the mercury thermometer. CO_2 samples are transferred into the volume by filling the ”exterior cup” (below the lowest visible pointer) with liquid nitrogen. An alternate, but unused sample column can be seen to the left (Column 3).

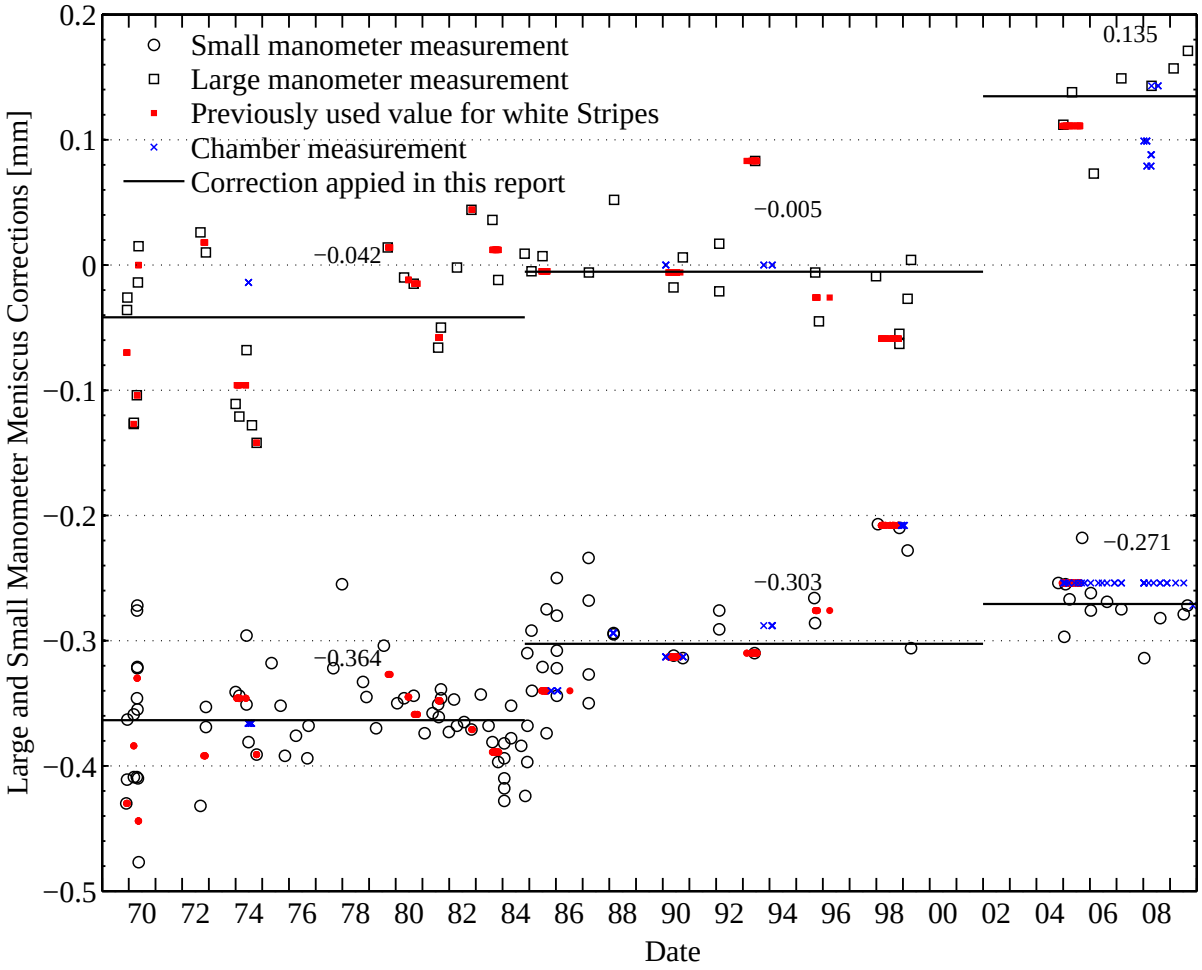


Figure 2: Measured and applied meniscus corrections for the small and large manometer. Black hollow circles or squares indicate individual measurements (see Table 1 and 2). The red points indicate values used in previous reports for determinations of the primary air manometric reference gases (white stripes). Blue crosses indicate values used here and in previous reports for chamber volume calibrations, in most cases these are actual measured values at that time. Solid lines indicate values used here in support of the X12 scale for all tank deteminations.

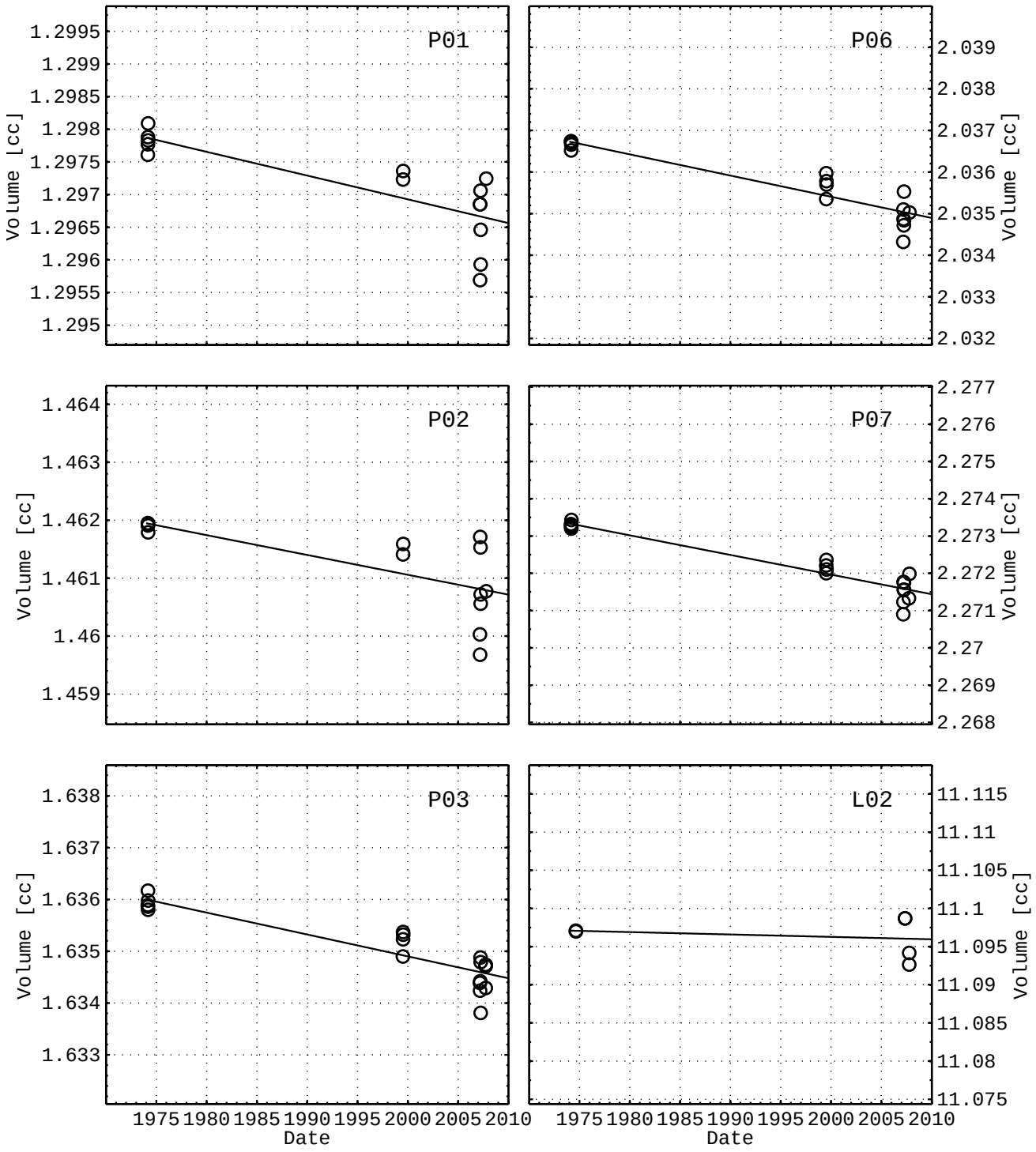


Figure 3: Individual volumes of the plenums P01, P02, P03, P06, P07 and L02 with linear fit. For comparison purposes, the y-axes have been scaled to show limits that represent a 0.4% change in each plenum's volume.

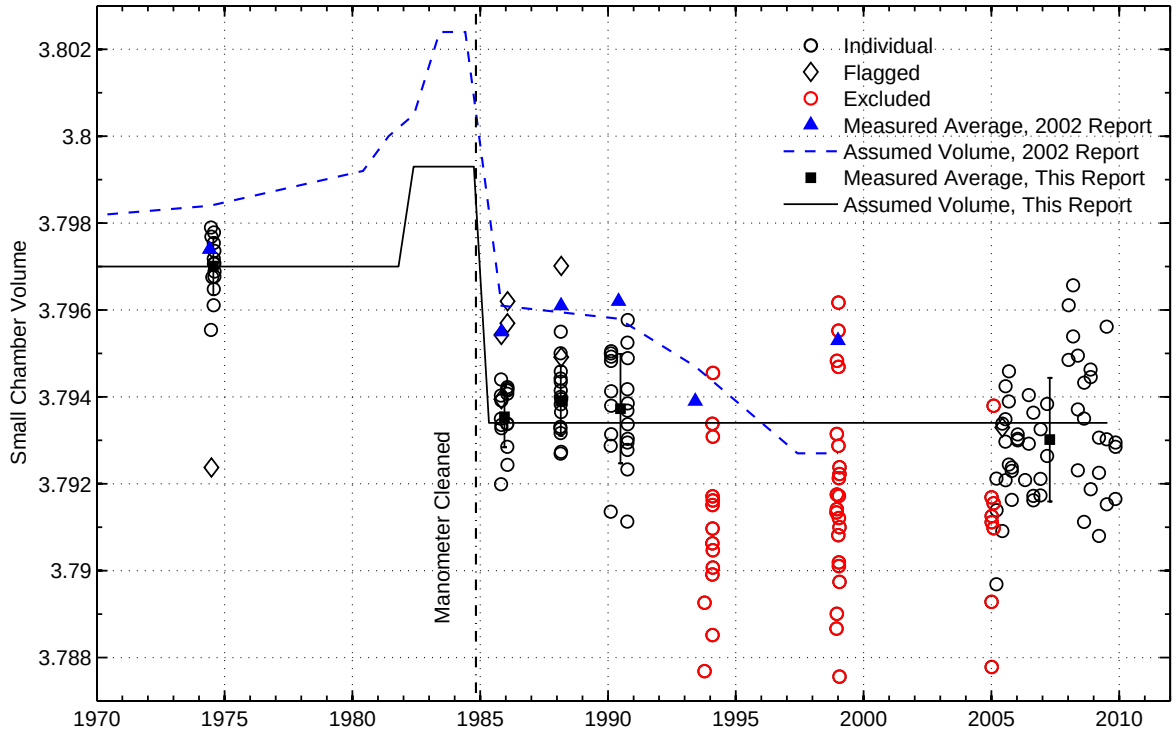


Figure 4: Variation of the manometer's small chamber volume over time. Individual volume determinations are indicated by the black circles. Analyses conducted in 1994, 1999 and early 2005 have been excluded from the averages and these volumes are indicated by red circles. Solid blue triangles represent average chamber volumes as recorded in the 2002 manometry technical report (tables 5.2 and 9.4a-e in that document). Solid black squares are the corresponding averages from this analysis over the same time periods. The solid black line indicates the assumed variation in the chamber's volume over time, while the blue dashed sloping line represents the variation assumed in 2002 report. The vertical dash-dot line indicates the time at which the manometer was cleaned.

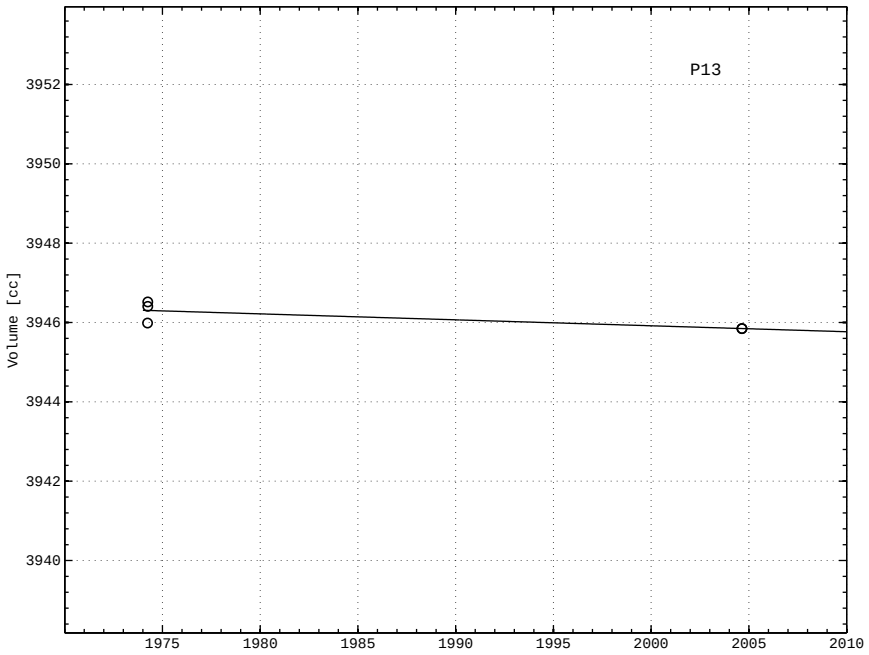


Figure 5: Individual volumes measurements of the plenum P13 used for calibrating the 5000 cc chamber, with linear fit. There are actually 3 data points for 2004 volumes, however these appear indistinguishable in this plot. The y-axis has been scaled to show limits that represent a 0.4% change in the plenum's volume for comparison with Figure 3.

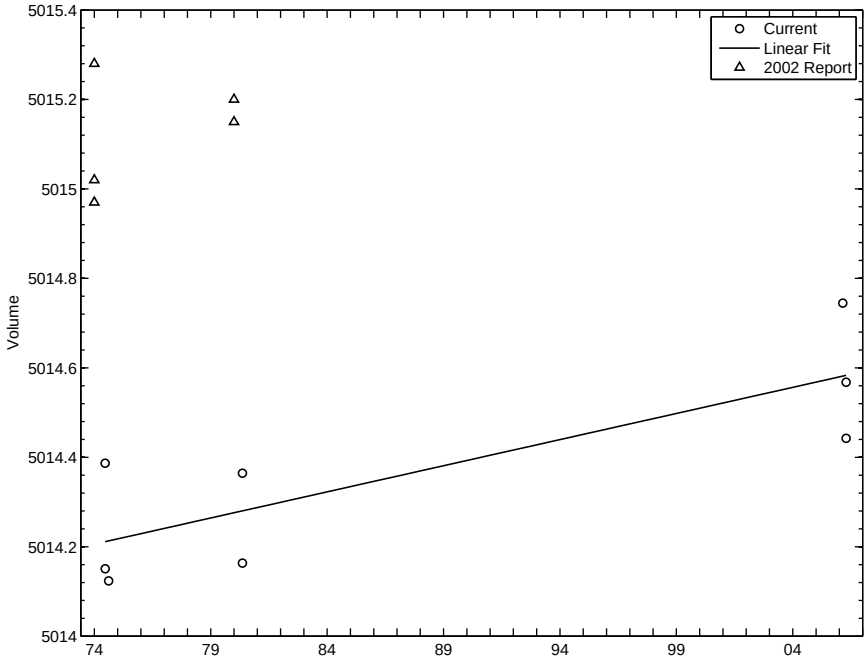


Figure 6: Variation of the manometer's 5 liter chamber volume over time. Individual volume determinations are indicated by black circles. Black triangles represent average chamber volumes as used in the 2002 manometry technical report. The solid black line indicates the assumed variation in the chamber's volume over time.

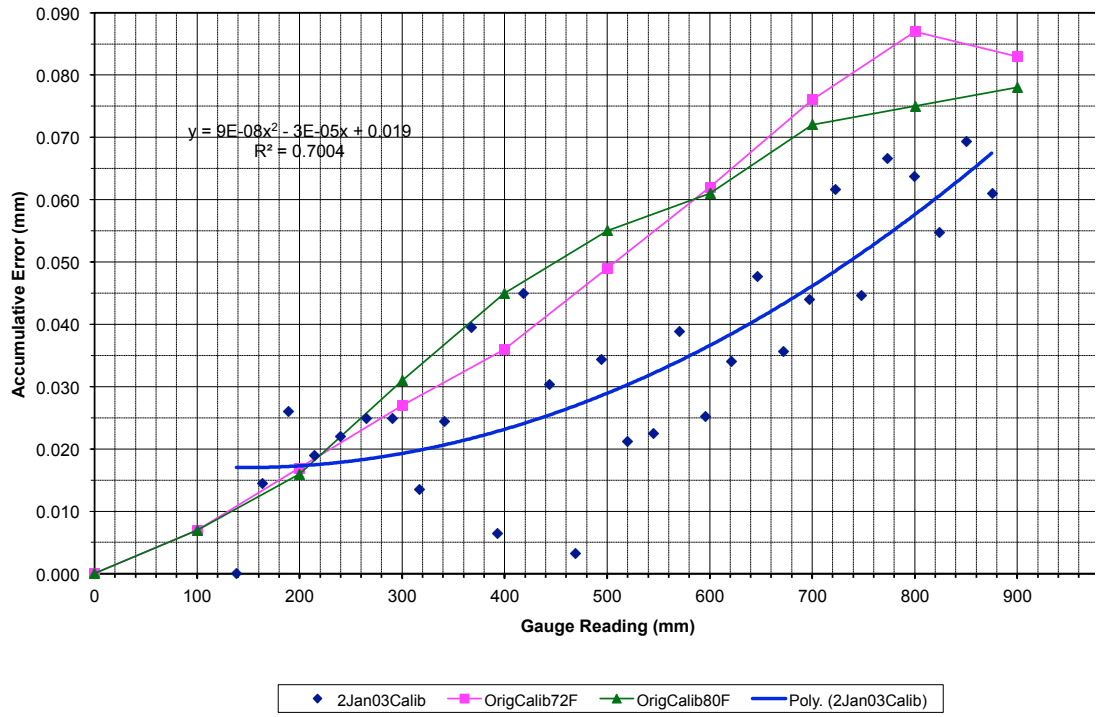


Figure 7: Calibration measurements of the cathetometer, comparing pitch against machinist's "Cadillac" gauge

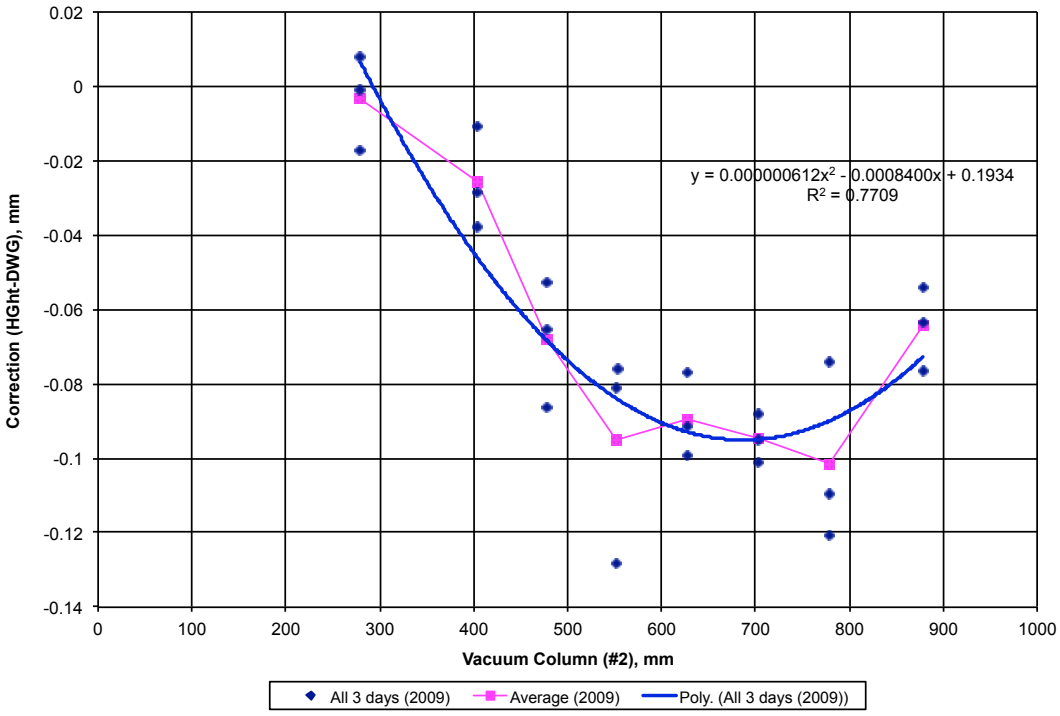


Figure 8: Calibration measurements for small chamber manometer, comparing pressure against dead-weight gauge.

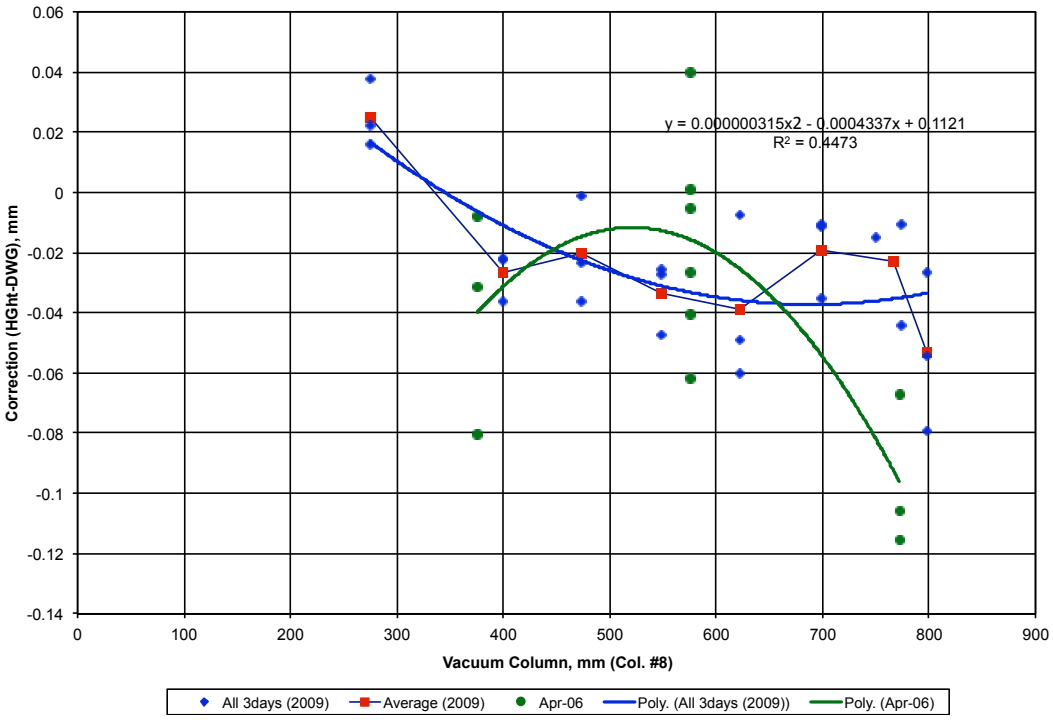


Figure 9: Calibration measurements for large chamber manometer, comparing pressure against dead-weight gauge

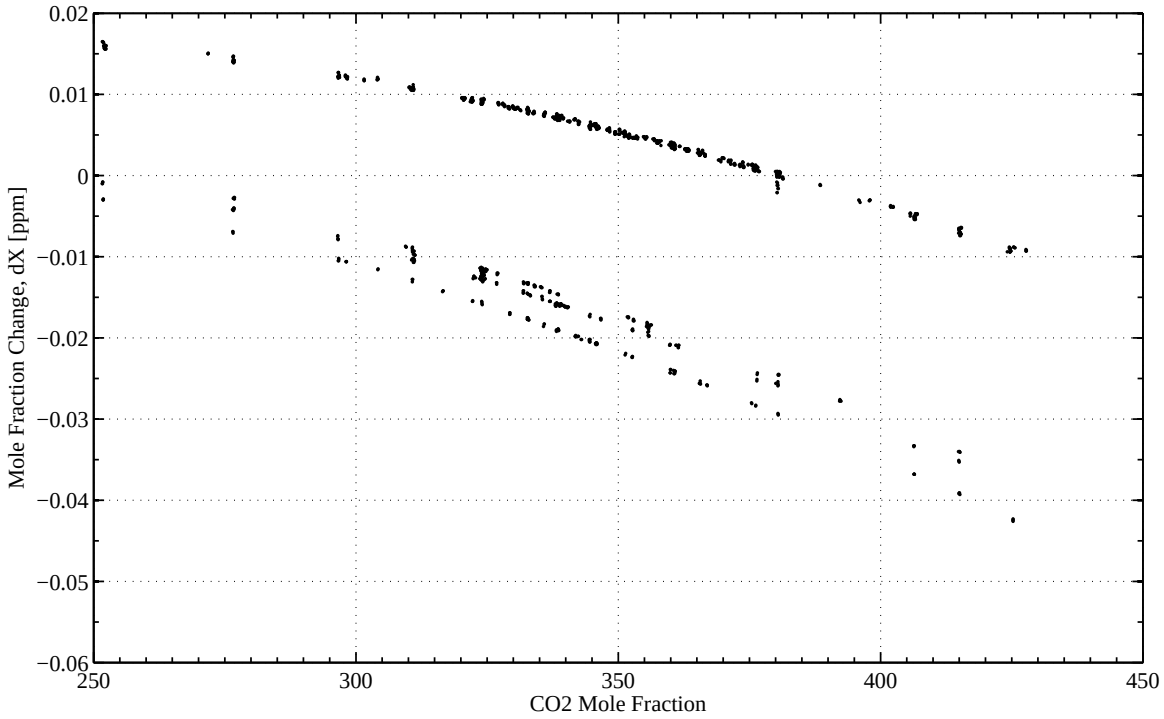


Figure 10: Effect of potential cathetomoter adjustment on manometric mole fractions. Each point is the shift in single manometric determination. These corrections, which were not fully understood (see text) were not applied for the X12A scale. The potential corrections here are additive. A correction of -0.04 ppm signifies that the manometric mole fraction would have been revised downward by 0.04 ppm had the correction been applied. The data can be seen to cluster along three lines, which are the result of the impact of the cathetometer adjustments on the determination of the 4cc volume, and the differing impacts in the three periods: pre 1982, 1982-1985, post 1985.

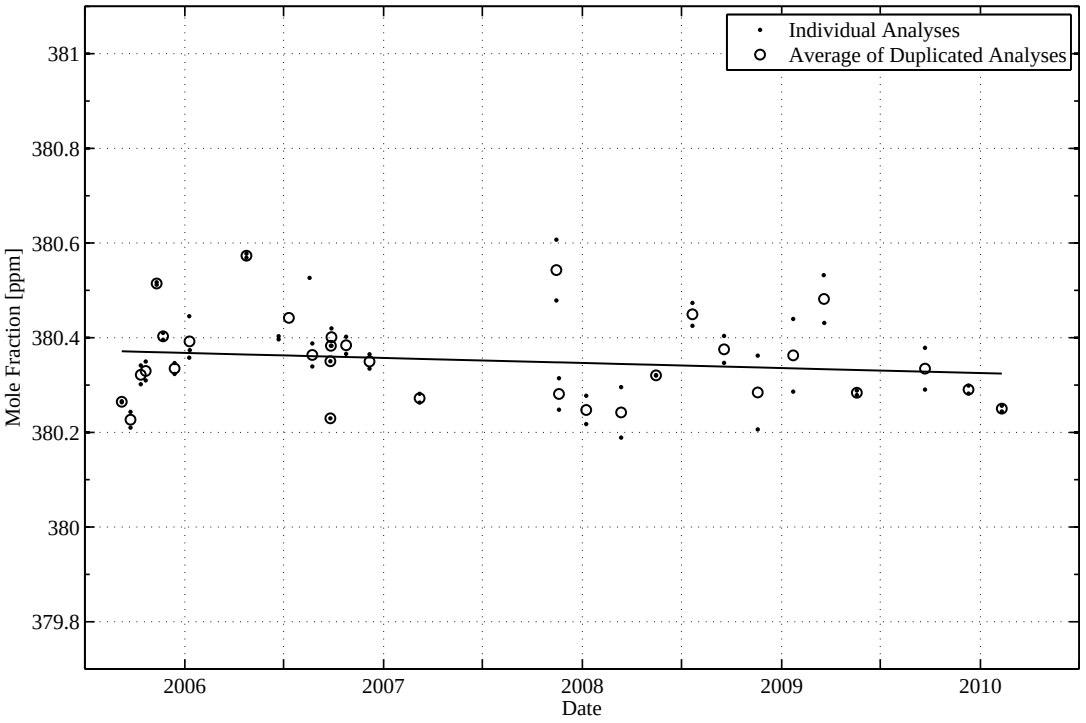


Figure 11: Time history of manometric determinations of tank 1661

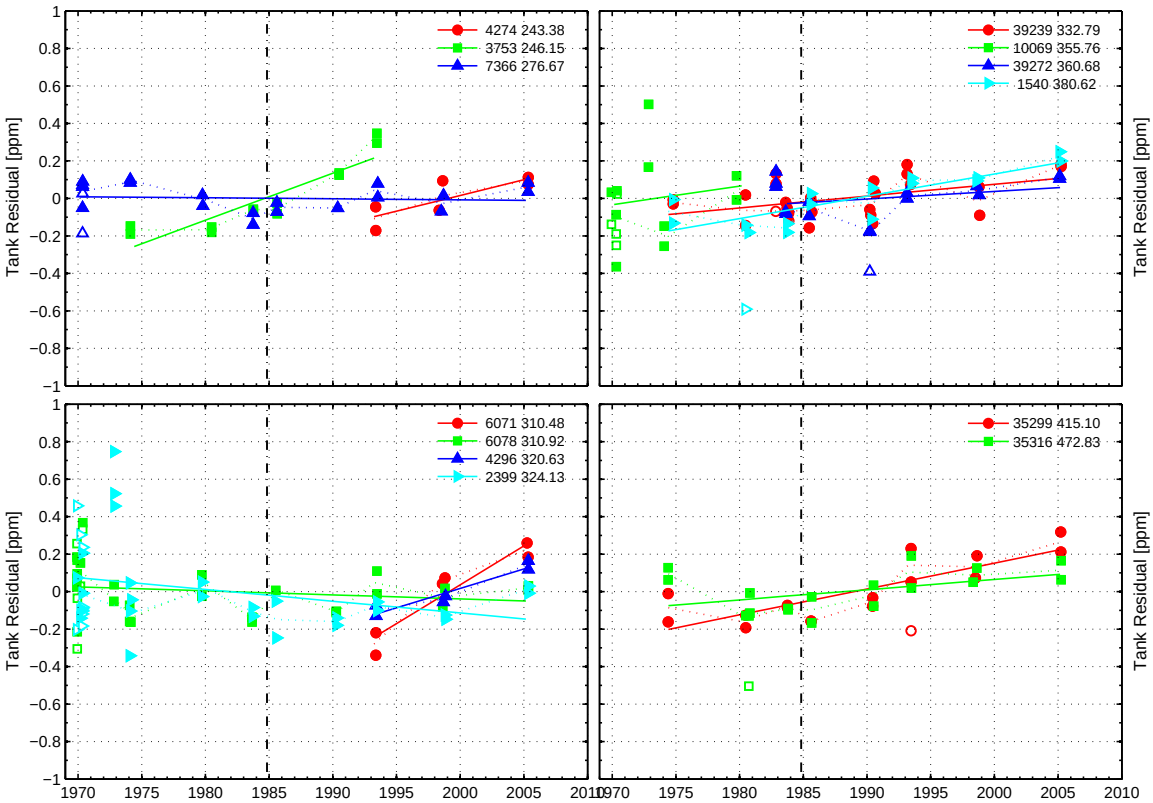


Figure 12: Residual of each nitrogen primary tank's observed carbon dioxide manometric mole fraction from the tank's average value over time. Open symbols represent flagged data that have been excluded from the average. Solid lines represent the assumed time varying concentration for each tank that is used to calculate APC cubic coefficients. Tanks are identified by cylinder ID number and average CO_2 concentrations in ppm.

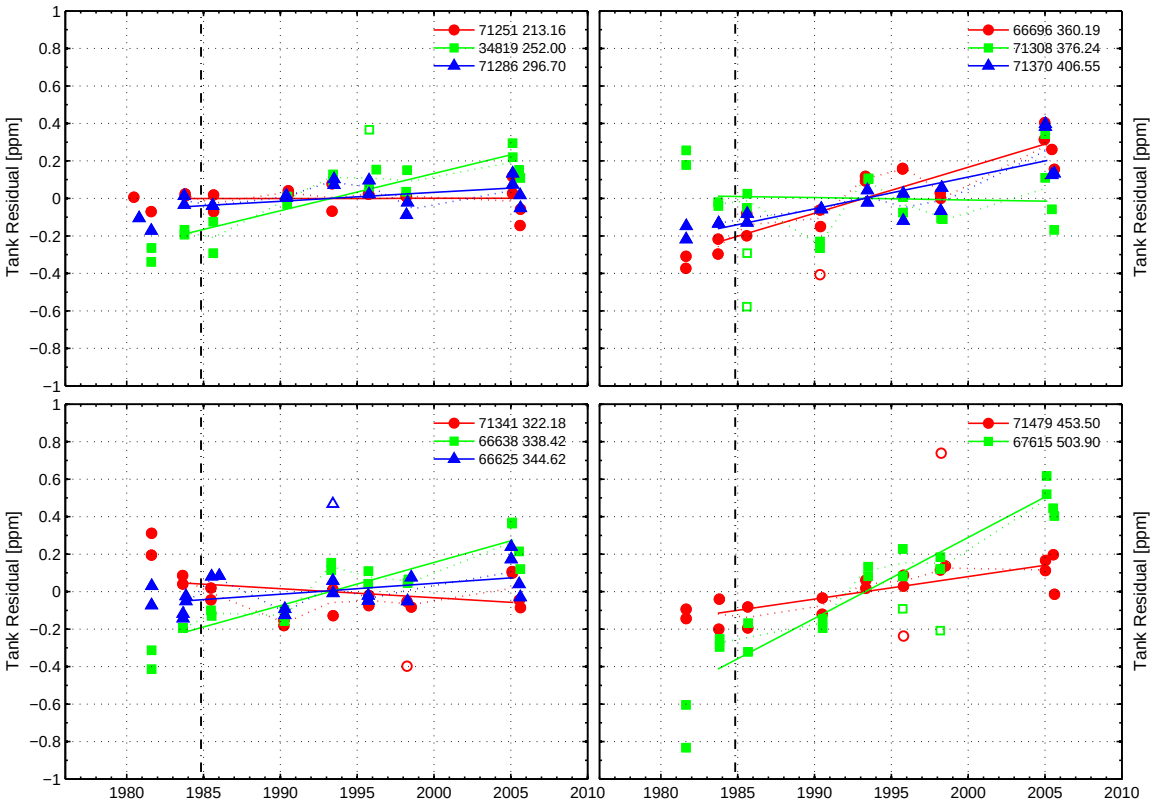


Figure 13: Residual of each air primary tank's observed carbon dioxide manometric mole fraction from the tank's average value over time. Open symbols represent flagged data that have been excluded from the average. Solid lines represent the assumed time varying concentration for each tank that is used to calculate APC cubic coefficients. Tanks are identified by cylinder ID number and average CO_2 concentrations in ppm.

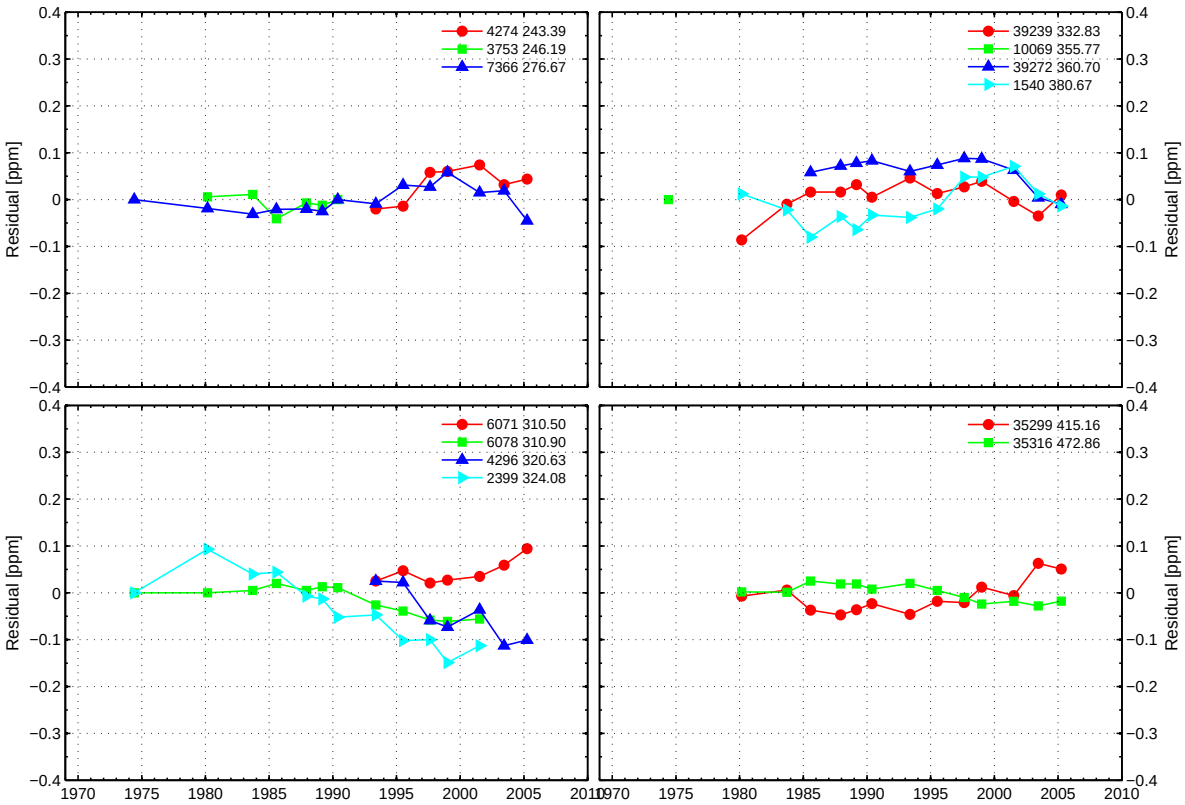


Figure 14: Residual of each nitrogen primary tank's manometric mole fraction X from the APC cubic fit X_A

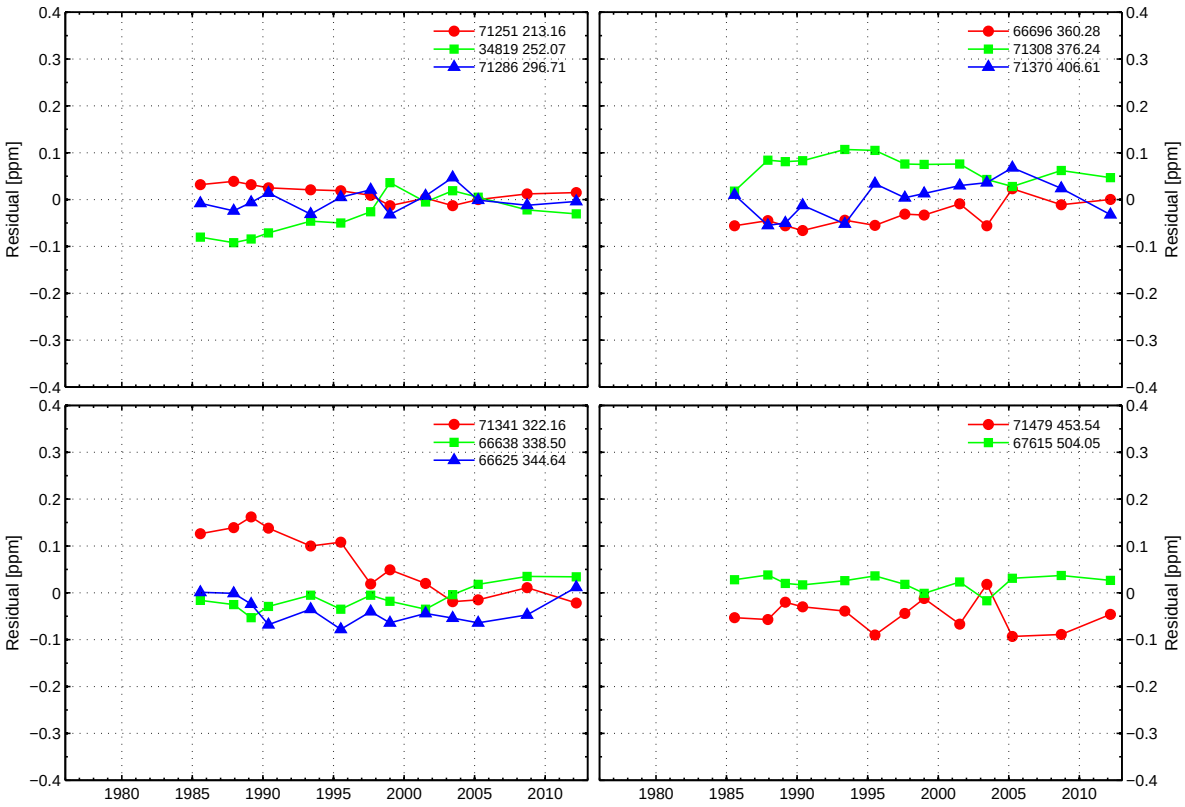


Figure 15: Residual of each air primary tank's manometric mole fraction X from the APC cubic fit X_A

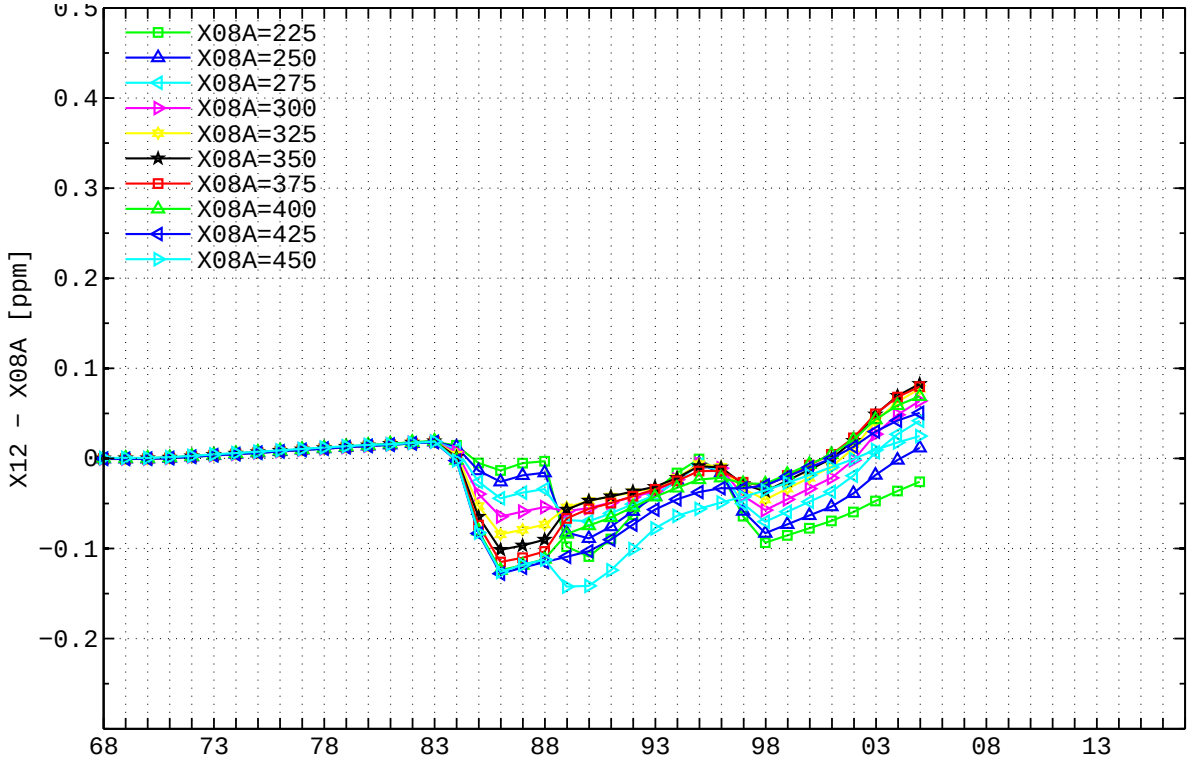


Figure 16: Difference between the X12 and X08A nitrogen calibration scale for the APC analyzer

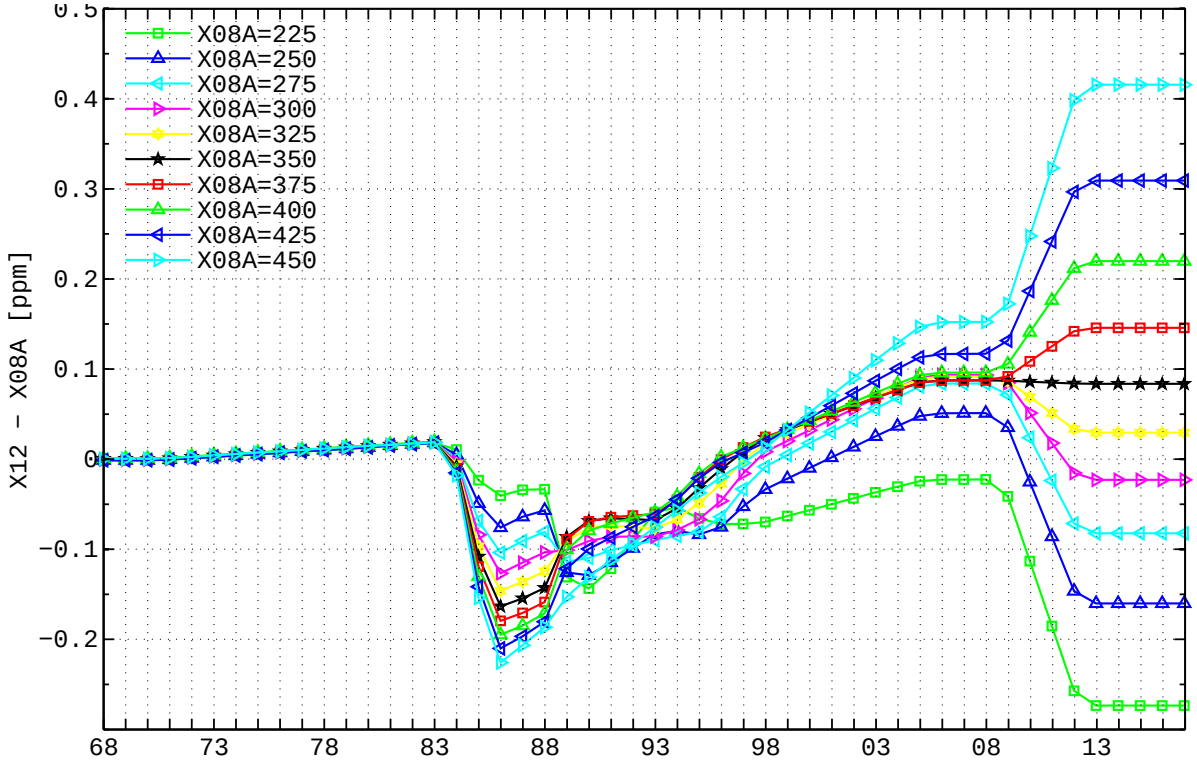


Figure 17: Difference between the X12 and X08A air calibration scale for the APC analyzer. The larger adjustments starting in 2008 and extending to 2015 reflect the need to correct for extrapolating the cubic corrections forward from the last marathon tank day in 2008. Similarly large corrections were needed between 2005 and 2008 when updating from the X2005A and X2008A scales.

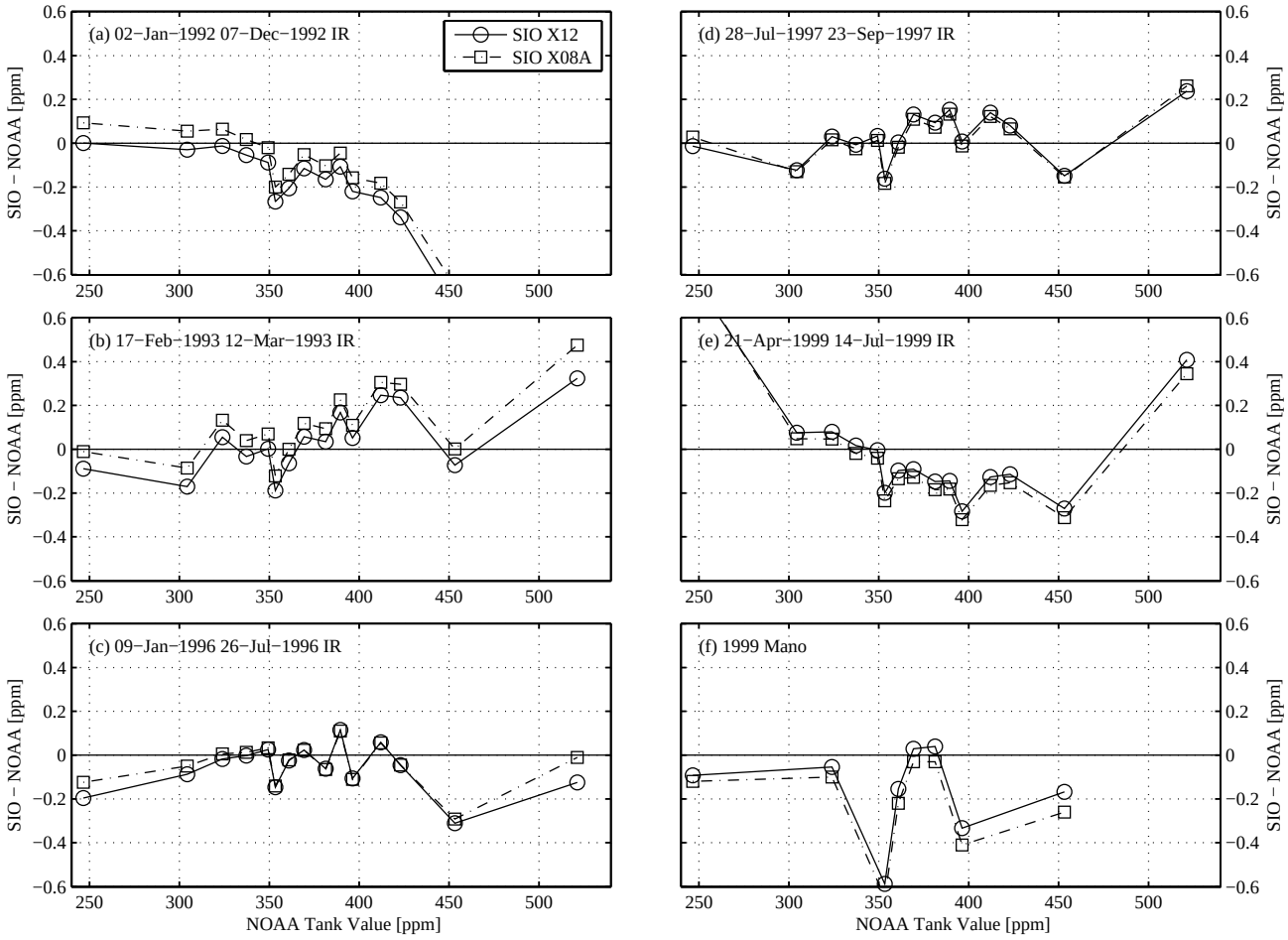


Figure 18: Comparison of cylinder concentrations for suite of gases received from NOAA in 1992. Figures show difference between values declared by NOAA and values measured at SIO on the X12 and X08A calibration scales. Panels (a) through (e) present difference between SIO IR values measured between the dates indicated in each legend and NOAA values. Panel (f) shows difference between SIO manometric determinations made in 1999 and NOAA.

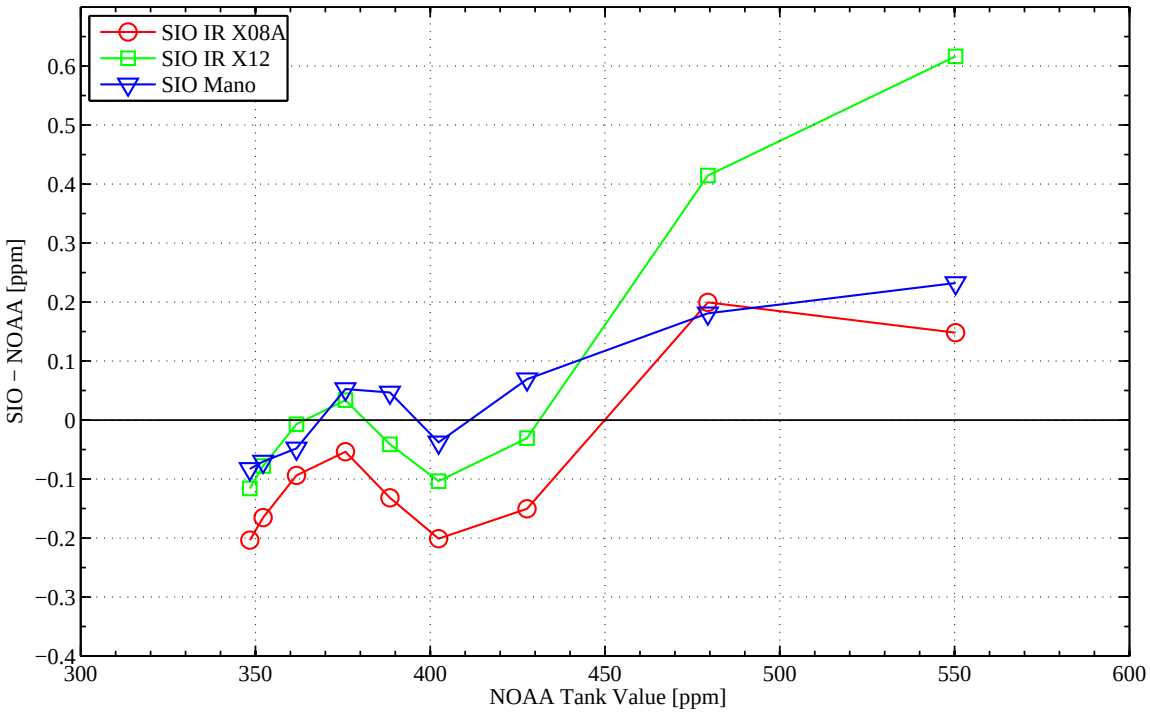


Figure 19: Comparison of NOAA cylinder concentrations measured in 2005, comparing values declared by NOAA with values measured at SIO on the X12 and X08A calibration scales. Red and Green curves show measurements of NOAA tanks made on the APC analyzer. Blue curve shows direct determinations of the NOAA tanks on the manometer.

17 Appendix A. Supplemental Tables

Table A1: Plenum Calibration Data Notes. Data and calculated results are listed for calibrations of the volumes of plenums by weighing them filled with mercury or with water. The plenums are glass containers equipped with vacuum stopcocks and are mostly used to calibrate, by transfer of CO2 gas, the volumes of chambers in the constant-volume mercury-column manometer (CMM) or the electronic constant-volume manometer (ECM). The calibrations were made between February 1974 and October 2008 by A. Adams (in 1974 and 1976), by P Guenther (mercury calibrations in 2007), and by G. Emanuele (all water calibrations from 1999 to 2008). Notes on the columns in the table follow.

Date	Date of the measurement, in YYYYMMDD
Med	Medium of the calibrating fluid, either water (h2o) or mercury (hg).
Plnm	Number of plenum. The original set of plenums used to calibrate the 4 cc chamber of the CMM in 1974 are numbered P01 to P07. The nominally 4000 cc flask, located within the CMM cabinet, and used to calibrate the 5000 cc chamber, is numbered P13.
Temp	Temperature, in C, of the calibration, in most cases that of a constant- temperature water bath into which the plenums were immersed after filling them with the calibrating fluid but before closing the stopcock. In 1974, no water bath was used: the thermometer was placed adjacent to the plenums, "in the air."
Wt-Full	Weight, in grams, of the plenum filled with the calibrating fluid
Wt-Empty	Weight, in grams, of the plenum evacuated.
Flg	Flag: two calibrations in 2007 (using water) are flagged, one with a "1" and the other with a "2".
Bthcor	Correction to the thermometer immersed in the water bath, if any.
Balcor1 Balcor2	Corrections to the weight, as determined by placing weights on the balance at the time of the full weight (Balcor1) and the evacuated weight (Balcor2). These weights in turn have a correction determined by weighing them on a calibrated balance: these "corrections to the corrections" are applied in the program. There are non-zero corrections only for some 2007 calibrations with water.
Buoy-Wt	Weight of the fluid corrected for the buoyancy of the weights, assuming stainless steel.
Rho	Density of the fluid, in g/cm^3, at the calibration temperature
Volume	Calculated volume of the plenum, in cm^3.

Table A1: Plenum Calibration Data. Page 1/3

Date	Med	Plnm	Temp	Wt-Full	Wt-Empty	Flg	Bthcor	Buoy-Wt	Rho	Volume
20070705	h2o	L01	22.293	75.1441	67.6889	0	0.02	7.45409	0.997706	7.47123
20070706	h2o	L01	22.293	75.1400	67.6819	0	0.02	7.45697	0.997706	7.47412
20070709	h2o	L01	22.310	75.1468	67.6891	0	0.02	7.45660	0.997702	7.47378
20070712	h2o	L01	22.312	75.1402	67.6818	0	0.02	7.45727	0.997702	7.47445
20070911	h2o	L01	22.305	75.1412	67.6835	0	0.02	7.45651	0.997703	7.47368
20070920	h2o	L01	22.304	75.1431	67.6883	1	0.02	7.45361	0.997703	7.47077
20081002	h2o	L01	22.300	75.1517	67.6933	0	0.02	7.45726	0.997704	7.47442
20081002	h2o	L01	22.302	75.1364	67.6805	0	0.02	7.45478	0.997704	7.47194
19740826	hg	L02	21.800	222.670	72.3770	0	0.00	150.270	13.5414	11.0971
19740827	hg	L02	21.400	222.684	72.3840	0	0.00	150.277	13.5424	11.0968
19740827	hg	L02	21.300	222.680	72.3720	0	0.00	150.285	13.5427	11.0972
20070510	h2o	L02	22.294	83.4425	72.3673	0	0.02	11.0735	0.997706	11.0990
20070510	h2o	L02	22.295	83.4472	72.3726	0	0.02	11.0730	0.997706	11.0984
20070511	h2o	L02	22.293	83.4439	72.3690	0	0.02	11.0732	0.997706	11.0987
20071008	h2o	L02	22.308	83.4407	72.3704	0	0.02	11.0687	0.997703	11.0942
20071009	h2o	L02	22.307	83.4379	72.3691	0	0.02	11.0672	0.997703	11.0926
20070501	h2o	L03	22.295	81.1031	68.4781	0	0.02	12.6231	0.997706	12.6521
20070502	h2o	L03	22.295	81.0984	68.4738	0	0.02	12.6227	0.997706	12.6517
20070430	h2o	L04	22.293	84.5277	70.8774	0	0.02	13.6482	0.997706	13.6796
20070430	h2o	L04	22.293	84.5228	70.8743	0	0.02	13.6464	0.997706	13.6778
20070501	h2o	L04	22.293	84.5221	70.8708	0	0.02	13.6492	0.997706	13.6806
20080619	h2o	L04	22.301	84.5352	70.8804	0	0.02	13.6528	0.997704	13.6842
20070502	h2o	L05	22.295	81.7606	65.5613	0	0.02	16.1969	0.997706	16.2341
20070502	h2o	L05	22.295	81.7576	65.5566	0	0.02	16.1986	0.997706	16.2359
20081002	h2o	L05	22.303	81.7537	65.5532	0	0.02	16.1982	0.997704	16.2354
20070510	h2o	L06	22.295	93.7860	77.5472	0	0.02	16.2363	0.997706	16.2737
20070511	h2o	L06	22.294	93.7871	77.5468	0	0.02	16.2379	0.997706	16.2752
20070514	h2o	L06	22.294	93.7914	77.5526	0	0.02	16.2363	0.997706	16.2736
20070502	h2o	L07	22.294	81.5167	63.2648	0	0.02	18.2492	0.997706	18.2911
20070502	h2o	L07	22.295	81.5108	63.2608	0	0.02	18.2473	0.997706	18.2892
20080619	h2o	L07	22.301	81.5116	63.2580	0	0.02	18.2509	0.997704	18.2929
20070514	h2o	L08	22.294	101.834	81.8350	0	0.02	19.9961	0.997706	20.0421
20070514	h2o	L08	22.295	101.833	81.8343	0	0.02	19.9962	0.997706	20.0422
20070514	h2o	L08	22.295	101.833	81.8342	0	0.02	19.9958	0.997706	20.0418
20070911	h2o	L08	22.306	101.814	81.8314	0	0.02	19.9792	0.997703	20.0252
19740301	hg	P01	21.200	69.9830	52.4070	0	0.00	17.5734	13.5429	1.29761
19740305	hg	P01	21.900	69.9850	52.4090	0	0.00	17.5734	13.5412	1.29777
19740308	hg	P01	21.100	69.9800	52.4000	0	0.00	17.5774	13.5432	1.29788
19740312	hg	P01	20.900	69.9980	52.4180	0	0.00	17.5774	13.5436	1.29783
19740314	hg	P01	22.000	69.9950	52.4150	0	0.00	17.5774	13.5409	1.29809
19990715	h2o	P01	23.090	53.7298	52.4356	0	-0.10	1.29402	0.997519	1.29723
19990720	h2o	P01	23.100	53.7148	52.4204	0	-0.10	1.29414	0.997517	1.29736
20070305	h2o	P01	22.302	53.7218	52.4277	0	0.02	1.29388	0.997704	1.29685
20070313	h2o	P01	22.302	53.7154	52.4225	0	0.02	1.29272	0.997704	1.29569
20070316	h2o	P01	22.298	53.7216	52.4275	0	0.02	1.29388	0.997705	1.29685
20070327	h2o	P01	22.294	53.7168	52.4226	0	0.02	1.29409	0.997706	1.29706
20070402	h2o	P01	22.295	53.7146	52.4214	0	0.02	1.29296	0.997706	1.29593
20070404	h2o	P01	22.294	53.7179	52.4243	0	0.02	1.29349	0.997706	1.29646
20071017	hg	P01	22.800	69.9910	52.4250	0	0.00	17.5634	13.5390	1.29724
20071017	hg	P01	22.800	69.9890	52.4260	0	0.00	17.5604	13.5390	1.29702
20071017	hg	P01	22.800	69.9880	52.4190	0	0.00	17.5664	13.5390	1.29747
19740301	hg	P02	21.200	72.2440	52.4420	0	0.00	19.7990	13.5429	1.46195
19740305	hg	P02	21.900	72.2420	52.4430	0	0.00	19.7960	13.5412	1.46191
19740308	hg	P02	21.100	72.2400	52.4380	0	0.00	19.7990	13.5432	1.46192
19740312	hg	P02	20.900	72.2420	52.4390	0	0.00	19.8000	13.5436	1.46194
19740314	hg	P02	22.000	72.2390	52.4420	0	0.00	19.7940	13.5409	1.46179
19990715	h2o	P02	23.100	53.9025	52.4445	0	-0.10	1.45778	0.997517	1.46141
19990720	h2o	P02	23.090	53.8934	52.4353	0	-0.10	1.45796	0.997519	1.46159
20070305	h2o	P02	22.301	53.9052	52.4483	0	0.02	1.45668	0.997704	1.46003
20070313	h2o	P02	22.300	53.8949	52.4384	0	0.02	1.45633	0.997704	1.45968
20070316	h2o	P02	22.298	53.8973	52.4387	0	0.02	1.45835	0.997705	1.46171
20070327	h2o	P02	22.294	53.8951	52.4367	0	0.02	1.45818	0.997706	1.46153
20070402	h2o	P02	22.294	53.8976	52.4402	0	0.02	1.45721	0.997706	1.46056
20070404	h2o	P02	22.294	53.8963	52.4387	0	0.02	1.45737	0.997706	1.46072
20071019	hg	P02	22.800	72.2230	52.4430	0	0.00	19.7770	13.5390	1.46075
20071019	hg	P02	22.800	72.2240	52.4440	0	0.00	19.7770	13.5390	1.46075
20071019	hg	P02	22.800	72.2250	52.4440	0	0.00	19.7780	13.5390	1.46082
19740301	hg	P03	21.200	76.2480	54.0900	0	0.00	22.1547	13.5429	1.63589
19740305	hg	P03	21.900	76.2480	54.0890	0	0.00	22.1557	13.5412	1.63617
19740308	hg	P03	21.100	76.2450	54.0870	0	0.00	22.1547	13.5432	1.63586
19740312	hg	P03	20.900	76.2470	54.0890	0	0.00	22.1547	13.5436	1.63580
19740314	hg	P03	22.000	76.2470	54.0910	0	0.00	22.1527	13.5409	1.63598
19990708	h2o	P03	20.400	55.7233	54.0912	0	-0.10	1.63184	0.998123	1.63490

Table A1: Plenum Calibration Data. Page 2/3

Date	Med	Plnm	Temp	Wt-Full	Wt-Empty	Flg	Bthcor	Buoy-Wt	Rho	Volume
19990713	h2o	P03	23.090	55.7200	54.0886	0	-0.10	1.63118	0.997519	1.63523
19990715	h2o	P03	23.080	55.7239	54.0923	0	-0.10	1.63132	0.997522	1.63537
19990720	h2o	P03	23.080	55.7188	54.0872	0	-0.10	1.63127	0.997522	1.63532
20070306	h2o	P03	22.301	55.7219	54.0911	0	0.02	1.63064	0.997704	1.63439
20070313	h2o	P03	22.301	55.7174	54.0867	0	0.02	1.63049	0.997704	1.63424
20070316	h2o	P03	22.299	55.7191	54.0882	0	0.02	1.63067	0.997705	1.63442
20070327	h2o	P03	22.294	55.7199	54.0886	0	0.02	1.63113	0.997706	1.63488
20070402	h2o	P03	22.295	55.7193	54.0880	0	0.02	1.63104	0.997706	1.63479
20070404	h2o	P03	22.294	55.7198	54.0895	0	0.02	1.63007	0.997706	1.63381
20070926	hg	P03	20.800	76.2340	54.0900	0	0.00	22.1407	13.5439	1.63474
20070927	hg	P03	21.000	76.2380	54.0960	0	0.00	22.1387	13.5434	1.63465
20070927	hg	P03	20.900	76.2330	54.0890	0	0.00	22.1407	13.5436	1.63477
20071001	h2o	P03	22.306	55.7265	54.0953	0	0.02	1.63098	0.997703	1.63473
20071002	h2o	P03	22.305	55.7225	54.0917	0	0.02	1.63054	0.997703	1.63429
19740226	hg	P04	20.200	81.1790	57.5300	0	0.00	23.6455	13.5454	1.74565
19740301	hg	P04	21.200	81.1680	57.5250	0	0.00	23.6395	13.5429	1.74552
19740305	hg	P04	21.900	81.1610	57.5210	0	0.00	23.6364	13.5412	1.74552
19740308	hg	P04	21.100	81.1680	57.5210	0	0.00	23.6435	13.5432	1.74579
19740312	hg	P04	20.900	81.1680	57.5190	0	0.00	23.6455	13.5436	1.74587
19990708	h2o	P04	20.400	59.2579	57.5180	0	-0.10	1.73967	0.998123	1.74294
19990713	h2o	P04	23.090	59.2585	57.5195	0	-0.10	1.73879	0.997519	1.74311
19990715	h2o	P04	23.100	59.2616	57.5229	0	-0.10	1.73844	0.997517	1.74277
19990720	h2o	P04	23.080	59.2540	57.5151	0	-0.10	1.73858	0.997522	1.74290
20070305	h2o	P04	22.302	59.2625	57.5245	0	0.02	1.73766	0.997704	1.74166
20070313	h2o	P04	22.301	59.2560	57.5183	0	0.02	1.73745	0.997704	1.74145
20070316	h2o	P04	22.298	59.2595	57.5215	0	0.02	1.73776	0.997705	1.74176
20070327	h2o	P04	22.293	59.2569	57.5200	2	0.02	1.73664	0.997706	1.74063
20070402	h2o	P04	22.295	59.2571	57.5187	0	0.02	1.73816	0.997706	1.74216
20070404	h2o	P04	22.294	59.2585	57.5204	0	0.02	1.73788	0.997706	1.74188
20071029	hg	P04	22.800	81.1080	57.5200	0	0.00	23.5845	13.5390	1.74197
20071029	hg	P04	22.800	81.1090	57.5200	0	0.00	23.5855	13.5390	1.74204
20071030	hg	P04	22.800	81.0920	57.5220	0	0.00	23.5665	13.5390	1.74064
19740308	hg	P05	21.100	102.457	77.5920	0	0.00	24.8613	13.5432	1.83571
19740312	hg	P05	20.900	102.459	77.5890	0	0.00	24.8663	13.5436	1.83601
19740314	hg	P05	22.000	102.463	77.5960	0	0.00	24.8633	13.5409	1.83615
19740314	hg	P05	21.600	102.454	77.5880	0	0.00	24.8623	13.5419	1.83595
19740315	hg	P05	21.900	102.456	77.5910	0	0.00	24.8613	13.5412	1.83597
19990708	h2o	P05	20.400	79.3762	77.5456	0	-0.10	1.83036	0.998123	1.83380
19990713	h2o	P05	23.090	79.3749	77.5452	0	-0.10	1.82942	0.997519	1.83396
19990715	h2o	P05	23.090	79.3810	77.5520	0	-0.10	1.82869	0.997519	1.83323
19990720	h2o	P05	23.080	79.3667	77.5373	0	-0.10	1.82911	0.997522	1.83365
20070305	h2o	P05	22.301	79.3844	77.5566	0	0.02	1.82757	0.997704	1.83177
20070313	h2o	P05	22.301	79.3731	77.5460	0	0.02	1.82683	0.997704	1.83103
20070316	h2o	P05	22.298	79.3734	77.5439	0	0.02	1.82917	0.997705	1.83337
20070327	h2o	P05	22.294	79.3743	77.5450	0	0.02	1.82900	0.997706	1.83320
20070402	h2o	P05	22.295	79.3675	77.5383	0	0.02	1.82891	0.997706	1.83311
20070404	h2o	P05	22.294	79.3668	77.5378	0	0.02	1.82870	0.997706	1.83290
20071030	hg	P05	22.800	102.355	77.5480	0	0.00	24.8033	13.5390	1.83199
20071030	hg	P05	22.800	102.352	77.5600	0	0.00	24.7883	13.5390	1.83088
20071030	hg	P05	22.800	102.361	77.5600	0	0.00	24.7973	13.5390	1.83155
19740301	hg	P06	21.100	86.2380	58.6500	0	0.00	27.5839	13.5432	2.03674
19740305	hg	P06	21.900	86.2320	58.6510	0	0.00	27.5769	13.5412	2.03652
19740308	hg	P06	21.100	86.2310	58.6430	0	0.00	27.5839	13.5432	2.03674
19740312	hg	P06	20.900	86.2320	58.6440	0	0.00	27.5839	13.5436	2.03666
19740314	hg	P06	22.000	86.2260	58.6430	0	0.00	27.5789	13.5409	2.03670
19990708	h2o	P06	20.400	60.6817	58.6499	0	-0.10	2.03154	0.998123	2.03535
19990713	h2o	P06	23.090	60.6777	58.6465	0	-0.10	2.03092	0.997519	2.03597
19990715	h2o	P06	23.060	60.6757	58.6446	0	-0.10	2.03075	0.997527	2.03578
19990720	h2o	P06	23.070	60.6713	58.6404	0	-0.10	2.03066	0.997524	2.03570
20070305	h2o	P06	22.300	60.6796	58.6496	0	0.02	2.02965	0.997704	2.03432
20070313	h2o	P06	22.301	60.6728	58.6420	0	0.02	2.03043	0.997704	2.03510
20070316	h2o	P06	22.298	60.6739	58.6433	0	0.02	2.03020	0.997705	2.03487
20070327	h2o	P06	22.295	60.6745	58.6441	0	0.02	2.03006	0.997706	2.03472
20070402	h2o	P06	22.294	60.6709	58.6398	0	0.02	2.03086	0.997706	2.03553
20070404	h2o	P06	22.294	60.6731	58.6426	0	0.02	2.03018	0.997706	2.03484
20071018	hg	P06	22.800	86.2050	58.6490	0	0.00	27.5519	13.5390	2.03500
20071018	hg	P06	22.800	86.2010	58.6450	0	0.00	27.5519	13.5390	2.03500
20071018	hg	P06	22.800	86.2040	58.6470	0	0.00	27.5529	13.5390	2.03508
19740301	hg	P07	21.200	88.6300	57.8380	0	0.00	30.7874	13.5429	2.27332
19740305	hg	P07	21.900	88.6230	57.8360	0	0.00	30.7824	13.5412	2.27324
19740308	hg	P07	21.100	88.6240	57.8320	0	0.00	30.7874	13.5432	2.27328
19740312	hg	P07	20.900	88.6220	57.8300	0	0.00	30.7874	13.5436	2.27320
19740314	hg	P07	22.000	88.6230	57.8340	0	0.00	30.7844	13.5409	2.27343

Table A1: Plenum Calibration Data. Page 3/3

Date	Med	Plnm	Temp	Wt-Full	Wt-Empty	Flg	Bthcor	Buoy-Wt	Rho	Volume
19990708	h2o	P07	20.400	60.1052	57.8370	0	-0.10	2.26795	0.998123	2.27221
19990713	h2o	P07	23.290	60.1037	57.8371	0	0.10	2.26626	0.997472	2.27200
19990715	h2o	P07	23.270	60.1017	57.8347	0	0.10	2.26663	0.997476	2.27236
19990720	h2o	P07	23.270	60.1002	57.8335	0	0.10	2.26637	0.997476	2.27210
20070305	h2o	P07	22.301	60.1055	57.8394	0	0.02	2.26569	0.997704	2.27090
20070313	h2o	P07	22.301	60.1020	57.8356	0	0.02	2.26602	0.997704	2.27123
20070316	h2o	P07	22.298	60.0979	57.8310	0	0.02	2.26656	0.997705	2.27177
20070327	h2o	P07	22.295	60.1008	57.8341	0	0.02	2.26634	0.997706	2.27155
20070402	h2o	P07	22.295	60.1024	57.8358	0	0.02	2.26635	0.997706	2.27156
20070404	h2o	P07	22.294	60.1003	57.8334	0	0.02	2.26654	0.997706	2.27175
20070928	hg	P07	21.200	88.5990	57.8340	0	0.00	30.7604	13.5429	2.27133
20071016	hg	P07	22.800	88.6020	57.8330	0	0.00	30.7644	13.5390	2.27228
20071016	hg	P07	22.800	88.5960	57.8350	0	0.00	30.7564	13.5390	2.27169
20070305	h2o	P08	22.302	66.6631	63.8691	0	0.02	2.79361	0.997704	2.80004
20070313	h2o	P08	22.300	66.6616	63.8658	0	0.02	2.79534	0.997704	2.80177
20070316	h2o	P08	22.298	66.6604	63.8646	0	0.02	2.79548	0.997705	2.80191
20070327	h2o	P08	22.294	66.6641	63.8679	0	0.02	2.79581	0.997706	2.80224
20070402	h2o	P08	22.294	66.6589	63.8643	0	0.02	2.79412	0.997706	2.80055
20070404	h2o	P08	22.294	66.6573	63.8635	0	0.02	2.79337	0.997706	2.79979
20070911	h2o	P08	22.305	66.6661	63.8717	0	0.02	2.79398	0.997703	2.80041
19740903	h2o	P09	21.200	152.772	101.414	0	0.00	51.3503	0.997951	51.4557
19740903	h2o	P09	21.200	152.777	101.420	0	0.00	51.3493	0.997951	51.4547
19740905	h2o	P09	21.600	152.766	101.413	0	0.00	51.3453	0.997863	51.4553
20080410	h2o	P09	22.284	152.741	101.418	0	0.02	51.3153	0.997708	51.4332
20080410	h2o	P09	22.305	152.738	101.414	0	0.02	51.3163	0.997703	51.4344
20070924	hg	P10	21.200	79.1760	56.2540	0	0.00	22.9186	13.5429	1.69229
20070924	hg	P10	21.400	79.1690	56.2540	0	0.00	22.9116	13.5424	1.69184
20070925	hg	P10	20.700	79.1770	56.2510	0	0.00	22.9226	13.5441	1.69243
20070925	hg	P10	20.800	79.1800	56.2480	0	0.00	22.9286	13.5439	1.69291
20071001	h2o	P10	22.303	57.9375	56.2487	0	0.02	1.68850	0.997704	1.69238
20071002	h2o	P10	22.306	57.9391	56.2502	0	0.02	1.68869	0.997703	1.69257
19760528	h2o	P11	20.100	475.623	205.264	0	0.00	270.318	0.998186	270.810
19760602	h2o	P11	20.100	475.634	205.256	0	0.00	270.337	0.998186	270.829
19760602	h2o	P11	20.100	475.612	205.244	0	0.00	270.327	0.998186	270.819
19760603	h2o	P11	20.100	475.598	205.255	0	0.00	270.302	0.998186	270.794
20080418	h2o	P11	22.305	475.340	205.240	0	0.02	270.059	0.997703	270.681
20080418	h2o	P11	22.305	475.360	205.250	0	0.02	270.069	0.997703	270.691
19740329	h2o	P13	22.100	5058.90	1121.20	0	0.00	3937.11	0.99775	3945.99
19740401	h2o	P13	21.900	5059.10	1120.80	0	0.00	3937.71	0.997796	3946.41
19740402	h2o	P13	21.800	5059.30	1120.80	0	0.00	3937.91	0.997818	3946.52
20080630	h2o	P12	22.300	1230.61	221.670	0	0.02	1008.79	0.997704	1011.11
20080701	h2o	P12	22.302	1230.56	221.670	0	0.02	1008.74	0.997704	1011.06
20040824	h2o	P13	22.279	5059.50	1122.10	0	-0.03	3936.81	0.997709	3945.85
20040825	h2o	P13	22.280	5059.50	1122.10	0	-0.03	3936.81	0.997709	3945.85
20040825	h2o	P13	22.278	5059.60	1122.20	0	-0.03	3936.81	0.997709	3945.85
19740109	h20	P14	18.500	6162.40	782.200	0	0.00	5379.39	0.998505	5387.45
19740110	h20	P14	18.800	6162.00	780.400	0	0.00	5380.79	0.998447	5389.16
19740111	h20	P14	17.300	6162.60	780.400	0	0.00	5381.39	0.998725	5388.26
19740114	h20	P14	18.100	6162.30	780.200	0	0.00	5381.29	0.99858	5388.95
19740115	h20	P14	19.100	6160.60	780.800	0	0.00	5378.99	0.998388	5387.68
20040818	h20	P14	22.273	6158.00	781.800	0	-0.03	5375.39	0.997711	5387.73
20040819	h20	P14	22.277	6158.10	781.800	0	-0.03	5375.49	0.99771	5387.83
20040820	h2o	P14	22.278	6158.00	781.800	0	-0.03	5375.39	0.997709	5387.73
19740117	h20	P15	21.000	6206.60	991.300	0	0.00	5214.52	0.997995	5224.99
19740117	h20	P15	17.900	6208.60	991.400	0	0.00	5216.42	0.998617	5223.64
19740122	h20	P15	16.300	6208.80	991.900	0	0.00	5216.12	0.998897	5221.88
19740123	h20	P15	20.300	6205.50	991.700	0	0.00	5213.02	0.998144	5222.71
19740124	h20	P15	21.200	6204.80	991.300	0	0.00	5212.72	0.997951	5223.42
19740125	h20	P15	20.500	6205.90	991.900	0	0.00	5213.22	0.998102	5223.13
19740129	h20	P16	21.000	6211.10	906.600	0	0.00	5303.70	0.997995	5314.36
19740130	h20	P16	21.200	6211.10	907.200	0	0.00	5303.10	0.997951	5313.99
19740129	h20	P17	21.000	6190.80	881.100	0	0.00	5308.90	0.997995	5319.57
19740130	h20	P17	21.200	6190.50	881.500	0	0.00	5308.20	0.997951	5319.10
19740129	h20	P18	21.000	6236.80	897.700	0	0.00	5338.30	0.997995	5349.02
19740130	h20	P18	21.200	6236.90	897.400	0	0.00	5338.70	0.997951	5349.66
19740131	h20	P19	21.100	6227.50	1000.40	0	0.00	5226.32	0.997973	5236.93
19740201	h20	P19	21.000	6226.90	1000.80	0	0.00	5225.32	0.997995	5235.81
19740131	h20	P20	21.100	6219.10	900.100	0	0.00	5318.20	0.997973	5329.00
19740201	h20	P20	21.000	6219.10	900.000	0	0.00	5318.30	0.997995	5328.99
20040713	h20	P21	22.286	6187.20	1118.30	0	-0.03	5068.14	0.997708	5079.78
20040714	h20	P21	22.285	6187.10	1118.20	0	-0.03	5068.14	0.997708	5079.78
20040715	h20	P21	22.287	6187.20	1118.30	0	-0.03	5068.14	0.997707	5079.79

Table A2: Plenum Fills using Fortin Barometer, 1974 to 1999 Notes. Data and calculated results are listed for fillings of plenums with pure CO2 gas from 1974 to 1999. The plenums were filled to ambient laboratory pressures, which were measured on a Fortin-type mercury barometer. The pressure was computed in the same way as for CMM data, using the mercury height and measured temperature of the barometer along with the acceleration of gravity. When combined with the known volume of the plenum and the fill temperature, the number of moles of CO2 contained in the plenum was calculated using the virial equation of state. Notes on the columns in the table follow.

Date	Date of the measurement, in YYYYMMDD.
Fill	Designated consecutive number of the plenum fill, with the prefix "B" referring to "barometer." Each plenum filled has a separate number, including those filled at the same time.
Plnm	Number of plenum. The original set of plenums (from 1.3 to 2.3 cc in volume) was used to calibrate the nominally 4 cc chamber in the CMM. Plenum P09 was used for the nominally 64 cc and 250 cc chambers.
Vol	Volume of the plenum, in cc, from the fit versus time of volume calibrations made between 1974 and 2008 (see Table 3).
BaroP	Mercury height measured on the mercury barometer in the laboratory, in mm Hg.
BaroCor	Correction to the measured barometer reading, determined by comparing mercury heights measured on the barometer and on the CMM functioning as a barometer, i.e. with the sample column open to the room, in mm Hg.
BaroT	Temperature of the mercury column in the barometer, in C.
BathT	Temperature of the water bath surrounding the plenum when filled with CO2, in C.
μ-Moles CO2	Calculated amount of CO2 in the plenum, in micromoles.
Flg	A "1" or "2" indicates rejected data, the former for statistical reasons and the latter for experimental reasons.

Table A2: Plenum Fills using Fortin Barometer, 1974 to 1999. Page 1/2

Date	Fill	Plnm	Vol	BaroP	BaroCor	BaroT	BathT	μ-MolesCO_2	Flg
19740620	B001	P07	2.2733	761.4	0.0	20.8	20.78	94.4635	00
19740620	B002	P01	1.2979	761.4	0.0	20.8	20.78	53.9302	00
19740626	B003	P01	1.2979	760.8	0.0	20.5	20.75	53.8959	01
19740626	B004	P07	2.2733	760.8	0.0	20.5	20.75	94.4036	00
19740709	B005	P07	2.2733	763.8	0.0	20.7	20.77	94.7677	02
19740709	B006	P01	1.2979	763.8	0.0	20.7	20.77	54.1038	00
19740729	B007	P07	2.2733	761.7	0.0	21.2	20.75	94.5036	00
19740729	B008	P01	1.2979	761.7	0.0	21.2	20.75	53.9530	00
19740730	B009	P01	1.2979	763.4	0.0	20.4	20.75	54.0820	00
19740730	B010	P07	2.2733	763.4	0.0	20.4	20.75	94.7294	00
19740801	B011	P07	2.2733	763.1	0.0	20.2	20.77	94.6889	00
19740801	B012	P01	1.2979	763.1	0.0	20.2	20.77	54.0588	00
19740807	B013	P03	1.6360	760.8	0.0	20.3	20.75	67.9395	00
19740807	B014	P05	1.8360	760.8	0.0	20.3	20.75	76.2449	00
19740807	B015	P04	1.7457	760.8	0.0	20.3	20.75	72.4948	00
19740807	B016	P01	1.2979	760.8	0.0	20.3	20.75	53.8977	00
19851024	B017	P01	1.2974	765.3	-0.2	21.5	21.86	53.9677	00
19851024	B018	P07	2.2727	765.3	-0.2	21.5	21.86	94.5344	00
19851024	B019	P01	1.2974	763.2	-0.2	21.3	21.86	53.8207	00
19851024	B020	P07	2.2727	763.2	-0.2	21.3	21.86	94.2770	00
19851030	B021	P01	1.2974	764.4	-0.2	21.2	21.96	53.8882	00
19851030	B022	P03	1.6355	764.4	-0.2	21.2	21.96	67.9291	00
19851030	B023	P04	1.7443	764.4	-0.2	21.2	21.96	72.4491	02
19851030	B024	P05	1.8348	764.4	-0.2	21.2	21.96	76.2065	02
19851030	B025	P07	2.2727	764.4	-0.2	21.2	21.96	94.3952	00
19860121	B026	P01	1.2974	764.5	-0.2	20.7	21.96	53.8998	00
19860121	B027	P02	1.4615	764.5	-0.2	20.7	21.96	60.7171	00
19860121	B028	P03	1.6355	764.5	-0.2	20.7	21.96	67.9438	00
19860121	B029	P06	2.0361	764.5	-0.2	20.7	21.96	84.5872	00
19860121	B030	P07	2.2727	764.5	-0.2	20.7	21.96	94.4157	00
19860123	B031	P01	1.2974	767.4	-0.2	21.0	21.96	54.1025	00
19860123	B032	P03	1.6355	767.4	-0.2	21.0	21.96	68.1993	00
19860123	B033	P05	1.8348	767.4	-0.2	21.0	21.96	76.5090	02
19860123	B034	P07	2.2727	767.4	-0.2	21.0	21.96	94.7707	00
19860123	B035	P04	1.7443	767.4	-0.2	21.0	21.96	72.7365	02
19880219	B036	P01	1.2974	766.6	-0.2	21.0	21.87	54.0594	00
19880219	B037	P07	2.2726	766.6	-0.2	21.0	21.87	94.6961	00
19880223	B038	P01	1.2974	764.9	-0.2	21.5	21.87	53.9339	00
19880223	B039	P02	1.4615	764.9	-0.2	21.5	21.87	60.7561	00
19880223	B040	P03	1.6354	764.9	-0.2	21.5	21.87	67.9871	00
19880223	B041	P06	2.0360	764.9	-0.2	21.5	21.87	84.6412	00
19880223	B042	P07	2.2726	764.9	-0.2	21.5	21.87	94.4764	00
19880225	B043	P07	2.2726	764.5	-0.2	21.3	21.86	94.4334	00
19880225	B044	P06	2.0360	764.5	-0.2	21.3	21.86	84.6027	00
19880225	B045	P03	1.6354	764.5	-0.2	21.3	21.86	67.9562	00
19880225	B046	P02	1.4615	764.5	-0.2	21.3	21.86	60.7285	00
19880225	B047	P01	1.2974	764.5	-0.2	21.3	21.86	53.9094	00
19880302	B048	P01	1.2974	763.4	-0.2	21.4	21.86	53.8304	00
19880302	B049	P02	1.4615	763.4	-0.2	21.4	21.86	60.6395	00
19880302	B050	P04	1.7440	763.4	-0.2	21.4	21.86	72.3645	02
19880302	B051	P05	1.8345	763.4	-0.2	21.4	21.86	76.1195	02
19880302	B052	P07	2.2726	763.4	-0.2	21.4	21.86	94.2950	00
19900208	B053	P01	1.2973	765.5	-0.1	20.5	21.87	53.9904	00
19900208	B054	P07	2.2725	765.5	-0.1	20.5	21.87	94.5762	00
19900208	B055	P09	51.4454	765.5	-0.1	20.5	21.87	2141.05	00
19900212	B056	P01	1.2973	763.5	-0.1	20.2	21.89	53.8478	00
19900212	B057	P07	2.2725	763.5	-0.1	20.2	21.89	94.3264	00
19900212	B058	P09	51.4454	763.5	-0.1	20.2	21.89	2135.40	00
19900214	B059	P01	1.2973	762.4	-0.1	20.9	21.87	53.7667	00
19900214	B060	P07	2.2725	762.4	-0.1	20.9	21.87	94.1842	00
19900214	B061	P02	1.4614	762.4	-0.1	20.9	21.87	60.5682	00
19900214	B062	P03	1.6353	762.4	-0.1	20.9	21.87	67.7765	00
19900214	B063	P06	2.0359	762.4	-0.1	20.9	21.87	84.3792	00
19900214	B064	P09	51.4454	762.4	-0.1	20.9	21.87	2132.18	00
19901004	B065	P01	1.2973	764.5	-0.1	21.7	22.04	53.8751	00
19901004	B066	P07	2.2725	764.5	-0.1	21.7	22.04	94.3746	00
19901004	B067	P02	1.4614	764.5	-0.1	21.7	22.04	60.6906	00
19901004	B068	P03	1.6353	764.5	-0.1	21.7	22.04	67.9134	00
19901004	B069	P06	2.0359	764.5	-0.1	21.7	22.04	84.5497	00
19901005	B070	P07	2.2725	763.1	-0.1	21.8	22.32	94.1083	00
19901005	B071	P01	1.2973	763.1	-0.1	21.8	22.32	53.7231	00
19901008	B072	P03	1.6353	764.0	-0.1	20.5	22.05	67.8812	00
19901008	B073	P01	1.2973	764.0	-0.1	20.5	22.05	53.8496	00

Table A2: Plenum Fills using Fortin Barometer, 1974 to 1999. Page 2/2

Date	Fill	Plnm	Vol	BaroP	BaroCor	BaroT	BathT	μ-MolesCO_2	Flg
19901008	B074	P07	2.2725	764.0	-0.1	20.5	22.05	94.3299	00
19901008	B075	P02	1.4614	764.0	-0.1	20.5	22.05	60.6619	00
19901008	B076	P06	2.0359	764.0	-0.1	20.5	22.05	84.5096	00
19931012	B077	P01	1.2972	764.1	-0.4	21.2	21.92	53.8482	00
19931012	B078	P07	2.2723	764.1	-0.4	21.2	21.92	94.3287	00
19931012	B079	P09	51.4430	764.1	-0.4	21.2	21.92	2135.53	00
19940131	B080	P01	1.2971	769.4	-0.4	19.8	21.92	54.2372	00
19940131	B081	P07	2.2723	769.4	-0.4	19.8	21.92	95.0104	00
19940131	B082	P02	1.4613	769.4	-0.4	19.8	21.92	61.0995	00
19940131	B083	P03	1.6352	769.4	-0.4	19.8	21.92	68.3703	00
19940131	B084	P06	2.0357	769.4	-0.4	19.8	21.92	85.1187	00
19940202	B085	P01	1.2971	765.0	-0.4	20.1	21.92	53.9223	00
19940202	B086	P07	2.2723	765.0	-0.4	20.1	21.92	94.4587	00
19940202	B087	P09	51.4429	765.0	-0.4	20.1	21.92	2138.48	00
19940207	B088	P01	1.2971	757.3	-0.4	21.6	22.97	53.1693	00
19940207	B089	P07	2.2723	757.3	-0.4	21.6	22.97	93.1397	00
19940207	B090	P02	1.4613	757.3	-0.4	21.6	22.97	59.8965	00
19940207	B091	P03	1.6352	757.3	-0.4	21.6	22.97	67.0242	00
19940207	B092	P06	2.0357	757.3	-0.4	21.6	22.97	83.4428	00
19940207	B093	P09	51.4428	757.3	-0.4	21.6	22.97	2108.62	00
19981210	B094	P01	1.2970	771.9	-0.3	20.4	21.92	54.4082	00
19981210	B095	P07	2.2720	771.9	-0.3	20.4	21.92	95.3122	00
19981214	B096	P01	1.2970	766.7	-0.3	20.7	21.92	54.0366	00
19981214	B097	P02	1.4611	766.7	-0.3	20.7	21.92	60.8749	00
19981214	B098	P03	1.6349	766.7	-0.3	20.7	21.92	68.1182	00
19981214	B099	P06	2.0355	766.7	-0.3	20.7	21.92	84.8052	00
19981214	B100	P07	2.2720	766.7	-0.3	20.7	21.92	94.6612	00
19990106	B101	P02	1.4611	766.7	-0.3	21.2	21.92	60.8692	00
19990106	B102	P07	2.2720	766.7	-0.3	21.2	21.92	94.6525	00
19990106	B103	P01	1.2970	766.7	-0.3	21.2	21.92	54.0316	00
19990106	B104	P06	2.0355	766.7	-0.3	21.2	21.92	84.7973	00
19990106	B105	P03	1.6349	766.7	-0.3	21.2	21.92	68.1119	00
19990113	B106	P01	1.2970	768.0	-0.3	20.7	21.92	54.1287	00
19990113	B107	P07	2.2720	768.0	-0.3	20.7	21.92	94.8225	00
19990113	B108	P02	1.4611	768.0	-0.3	20.7	21.92	60.9786	00
19990113	B109	P06	2.0355	768.0	-0.3	20.7	21.92	84.9496	00
19990113	B110	P03	1.6349	768.0	-0.3	20.7	21.92	68.2342	00
19990121	B111	P01	1.2970	768.7	-0.3	21.1	21.92	54.1743	00
19990121	B112	P07	2.2720	768.7	-0.3	21.1	21.92	94.9024	00
19990121	B113	P02	1.4611	768.7	-0.3	21.1	21.92	61.0300	00
19990121	B114	P06	2.0355	768.7	-0.3	21.1	21.92	85.0212	00
19990121	B115	P03	1.6349	768.7	-0.3	21.1	21.92	68.2918	00

Table A3: Plenum Fills using Dead Weight Gauge, 1999 to 2008. Notes Data and calculated results are listed for fillings of plenums with pure CO2 gas from 1999 to 2008. The plenums were filled to pressures that were determined on a Ruska Dead Weight Gauge (DWG). The pressure was computed from the weights applied to the DWG piston during operation and the measured temperature and residual pressure in the bell jar of the DWG for correction. When combined with the known volume of the plenum and the fill temperature, the number of moles of CO2 contained in the plenum was calculated using the virial equation of state. Notes on the columns in the table follow.

Date	Date of the measurement, in YYYYMMDD.
Fill	Designated number of the plenum fill, with the prefix "D" referring to "DWG." A single fill number applies to all plenums (up to eight) filled at the same time, i.e. to the same pressure. The large plenums used for calibration of large CMM volumes in 2008 have the prefix "E" and were filled individually.
Plnm	Number of plenum. The original set of plenums with prefix P and the set of larger plenums with prefix L (from 7 to 20 cc in volume) were used to calibrate the small CMM chamber and the chambers in the Electronic Constant-Volume Manometers (ECMs).
Vol	Volume of the plenum, in cc, from the fit versus time of volume calibrations made between 1974 and 2008 (see Table 3).
BellP	Pressure in the bell jar of the DWG during the determination of pressure, in millitorr. This was used to correct the pressure determined by the DWG.
DWGT	Temperature of the DWG during the determination of pressure, in C.
DWGMassNos	Numbers of the weights used on the piston of the DWG for determination of pressure.
DWGP	Calculated pressure, in mm Hg.
BathT	Temperature of the water bath surrounding the plenum when filled with CO_2, in C.
μ-MolesCO2	Calculated amount of CO_2 in the plenum, in micromoles.
Flg	Flag column: none are listed.

Table A3: Plenum Fills using Dead Weight Gauge (DWG), 1999 to 2008. Page 1/8

Date	Fill	Plnm	Vol	BellP	DWGT	DWGMassNos	DWGP	BathT	μ-MolesCO2	Flg
19990608	D001	P03	1.6349	17.5	22.0	1,2,3,7,8,13	737.14	20.93	66.0527	00
19990608	D001	P04	1.7427	17.5	22.0	1,2,3,7,8,13	737.14	20.93	70.4070	00
19990608	D001	P05	1.8334	17.5	22.0	1,2,3,7,8,13	737.14	20.93	74.0699	00
19990608	D001	P06	2.0354	17.5	22.0	1,2,3,7,8,13	737.14	20.93	82.2337	00
19990608	D001	P07	2.2720	17.5	22.0	1,2,3,7,8,13	737.14	20.93	91.7910	00
19990610	D002	P03	1.6349	10.0	22.3	1,2,3,7,8,13	737.13	20.93	66.0515	00
19990610	D002	P04	1.7427	10.0	22.3	1,2,3,7,8,13	737.13	20.93	70.4058	00
19990610	D002	P05	1.8334	10.0	22.3	1,2,3,7,8,13	737.13	20.93	74.0685	00
19990610	D002	P06	2.0354	10.0	22.3	1,2,3,7,8,13	737.13	20.93	82.2323	00
19990610	D002	P07	2.2720	10.0	22.3	1,2,3,7,8,13	737.13	20.93	91.7894	00
19990614	D003	P03	1.6349	14.1	22.0	1,2,3,7,8,13	737.14	20.47	66.1575	00
19990614	D003	P04	1.7427	14.1	22.0	1,2,3,7,8,13	737.14	20.47	70.5187	00
19990614	D003	P05	1.8334	14.1	22.0	1,2,3,7,8,13	737.14	20.47	74.1873	00
19990614	D003	P06	2.0354	14.1	22.0	1,2,3,7,8,13	737.14	20.47	82.3642	00
19990614	D003	P07	2.2720	14.1	22.0	1,2,3,7,8,13	737.14	20.47	91.9366	00
19990617	D004	P03	1.6349	13.9	22.5	1,2,3,7,8,13	737.13	20.51	66.1482	00
19990617	D004	P04	1.7427	13.9	22.5	1,2,3,7,8,13	737.13	20.51	70.5087	00
19990617	D004	P05	1.8334	13.9	22.5	1,2,3,7,8,13	737.13	20.51	74.1769	00
19990617	D004	P06	2.0354	13.9	22.5	1,2,3,7,8,13	737.13	20.51	82.3526	00
19990617	D004	P07	2.2720	13.9	22.5	1,2,3,7,8,13	737.13	20.51	91.9237	00
19990623	D005	P03	1.6349	14.0	22.3	1,2,3,7,8,13	737.13	20.51	66.1480	00
19990623	D005	P04	1.7427	14.0	22.3	1,2,3,7,8,13	737.13	20.51	70.5085	00
19990623	D005	P05	1.8334	14.0	22.3	1,2,3,7,8,13	737.13	20.51	74.1766	00
19990623	D005	P06	2.0354	14.0	22.3	1,2,3,7,8,13	737.13	20.51	82.3524	00
19990623	D005	P07	2.2720	14.0	22.3	1,2,3,7,8,13	737.13	20.51	91.9235	00
19990628	D006	P03	1.6349	12.0	22.0	1,2,3,7,8,13	737.13	20.47	66.1576	00
19990628	D006	P04	1.7427	12.0	22.0	1,2,3,7,8,13	737.13	20.47	70.5187	00
19990628	D006	P05	1.8334	12.0	22.0	1,2,3,7,8,13	737.13	20.47	74.1873	00
19990628	D006	P06	2.0354	12.0	22.0	1,2,3,7,8,13	737.13	20.47	82.3643	00
19990628	D006	P07	2.2720	12.0	22.0	1,2,3,7,8,13	737.13	20.47	91.9368	00
20000324	D007	P03	1.6349	12.0	22.0	1,2,3,7,8,13	737.13	22.12	65.7799	00
20000324	D007	P04	1.7426	12.0	22.0	1,2,3,7,8,13	737.13	22.12	70.1139	00
20000324	D007	P05	1.8333	12.0	22.0	1,2,3,7,8,13	737.13	22.12	73.7622	00
20000324	D007	P06	2.0354	12.0	22.0	1,2,3,7,8,13	737.13	22.12	81.8942	00
20000324	D007	P07	2.2720	12.0	22.0	1,2,3,7,8,13	737.13	22.12	91.4122	00
20000329	D008	P04	1.7426	12.0	22.3	1,2,3,7,8,13	737.13	22.31	70.0677	00
20000329	D008	P05	1.8333	12.0	22.3	1,2,3,7,8,13	737.13	22.31	73.7135	00
20000329	D008	P06	2.0354	12.0	22.3	1,2,3,7,8,13	737.13	22.31	81.8402	00
20000329	D008	P07	2.2720	12.0	22.3	1,2,3,7,8,13	737.13	22.31	91.3519	00
20000330	D009	P03	1.6349	11.0	21.5	1,2,3,7,8,13	737.14	22.32	65.7350	00
20000330	D009	P04	1.7426	11.0	21.5	1,2,3,7,8,13	737.14	22.32	70.0660	00
20000330	D009	P05	1.8333	11.0	21.5	1,2,3,7,8,13	737.14	22.32	73.7118	00
20000330	D009	P06	2.0354	11.0	21.5	1,2,3,7,8,13	737.14	22.32	81.8383	00
20000330	D009	P07	2.2720	11.0	21.5	1,2,3,7,8,13	737.14	22.32	91.3498	00
20000330	D010	P03	1.6349	11.0	22.2	1,2,3,7,8,13	737.13	22.32	65.7343	00
20000330	D010	P04	1.7426	11.0	22.2	1,2,3,7,8,13	737.13	22.32	70.0653	00
20000330	D010	P05	1.8333	11.0	22.2	1,2,3,7,8,13	737.13	22.32	73.7110	00
20000330	D010	P06	2.0354	11.0	22.2	1,2,3,7,8,13	737.13	22.32	81.8374	00
20000330	D010	P07	2.2720	11.0	22.2	1,2,3,7,8,13	737.13	22.32	91.3488	00
20000331	D011	P03	1.6349	10.5	22.2	1,2,3,7,8,13	737.13	22.32	65.7343	00
20000331	D011	P04	1.7426	10.5	22.2	1,2,3,7,8,13	737.13	22.32	70.0652	00
20000331	D011	P05	1.8333	10.5	22.2	1,2,3,7,8,13	737.13	22.32	73.7109	00
20000331	D011	P06	2.0354	10.5	22.2	1,2,3,7,8,13	737.13	22.32	81.8374	00
20000331	D011	P07	2.2720	10.5	22.2	1,2,3,7,8,13	737.13	22.32	91.3487	00
20000331	D012	P03	1.6349	10.0	22.2	1,2,3,7,8,13	737.13	22.32	65.7342	00
20000331	D012	P04	1.7426	10.0	22.2	1,2,3,7,8,13	737.13	22.32	70.0652	00
20000331	D012	P05	1.8333	10.0	22.2	1,2,3,7,8,13	737.13	22.32	73.7109	00
20000331	D012	P06	2.0354	10.0	22.2	1,2,3,7,8,13	737.13	22.32	81.8373	00
20000331	D012	P07	2.2720	10.0	22.2	1,2,3,7,8,13	737.13	22.32	91.3487	00
20000707	D013	P03	1.6349	10.2	22.0	1,2,3,7,8,13	737.13	22.82	65.6211	00
20000707	D013	P04	1.7426	10.2	22.0	1,2,3,7,8,13	737.13	22.82	69.9437	00
20000707	D013	P05	1.8333	10.2	22.0	1,2,3,7,8,13	737.13	22.82	73.5834	00
20000707	D013	P06	2.0354	10.2	22.0	1,2,3,7,8,13	737.13	22.82	81.6964	00
20000707	D013	P07	2.2719	10.2	22.0	1,2,3,7,8,13	737.13	22.82	91.1915	00
20000707	D014	P03	1.6349	10.8	22.1	1,2,3,7,8,13	737.13	22.82	65.6210	00
20000707	D014	P04	1.7426	10.8	22.1	1,2,3,7,8,13	737.13	22.82	69.9437	00
20000707	D014	P05	1.8333	10.8	22.1	1,2,3,7,8,13	737.13	22.82	73.5833	00
20000707	D014	P06	2.0354	10.8	22.1	1,2,3,7,8,13	737.13	22.82	81.6964	00
20000707	D014	P07	2.2719	10.8	22.1	1,2,3,7,8,13	737.13	22.82	91.1914	00
20000725	D015	P03	1.6349	14.0	23.5	1,2,3,7,8,13	737.12	22.84	65.6153	00
20000725	D015	P04	1.7426	14.0	23.5	1,2,3,7,8,13	737.12	22.84	69.9375	00
20000725	D015	P05	1.8332	14.0	23.5	1,2,3,7,8,13	737.12	22.84	73.5768	00
20000725	D015	P06	2.0354	14.0	23.5	1,2,3,7,8,13	737.12	22.84	81.6893	00

Table A3: Plenum Fills using Dead Weight Gauge (DWG), 1999 to 2008. Page 2/8

Date	Fill	Plnm	Vol	BellP	DWGT	DWGMassNos	DWGP	BathT	μ-MolesCO2	Flg
20000725	D015	P07	2.2719	14.0	23.5	1,2,3,7,8,13	737.12	22.84	91.1835	00
20000727	D016	P03	1.6349	14.0	23.5	1,2,3,7,8,13	737.12	22.83	65.6176	00
20000727	D016	P04	1.7426	14.0	23.5	1,2,3,7,8,13	737.12	22.83	69.9398	00
20000727	D016	P05	1.8332	14.0	23.5	1,2,3,7,8,13	737.12	22.83	73.5793	00
20000727	D016	P06	2.0354	14.0	23.5	1,2,3,7,8,13	737.12	22.83	81.6921	00
20000727	D016	P07	2.2719	14.0	23.5	1,2,3,7,8,13	737.12	22.83	91.1866	00
20000727	D017	P03	1.6349	11.0	23.3	1,2,3,7,8,13	737.12	22.83	65.6175	00
20000727	D017	P04	1.7426	11.0	23.3	1,2,3,7,8,13	737.12	22.83	69.9398	00
20000727	D017	P05	1.8332	11.0	23.3	1,2,3,7,8,13	737.12	22.83	73.5792	00
20000727	D017	P06	2.0354	11.0	23.3	1,2,3,7,8,13	737.12	22.83	81.6920	00
20000727	D017	P07	2.2719	11.0	23.3	1,2,3,7,8,13	737.12	22.83	91.1865	00
20001102	D018	P03	1.6349	17.0	22.9	1,2,3,7,8,13	737.13	22.83	65.6180	00
20001102	D018	P04	1.7425	17.0	22.9	1,2,3,7,8,13	737.13	22.83	69.9395	00
20001102	D018	P05	1.8332	17.0	22.9	1,2,3,7,8,13	737.13	22.83	73.5792	00
20001102	D018	P06	2.0354	17.0	22.9	1,2,3,7,8,13	737.13	22.83	81.6926	00
20001102	D018	P07	2.2719	17.0	22.9	1,2,3,7,8,13	737.13	22.83	91.1873	00
20001102	D019	P03	1.6349	12.5	23.4	1,2,3,7,8,13	737.12	22.83	65.6171	00
20001102	D019	P04	1.7425	12.5	23.4	1,2,3,7,8,13	737.12	22.83	69.9385	00
20001102	D019	P05	1.8332	12.5	23.4	1,2,3,7,8,13	737.12	22.83	73.5781	00
20001102	D019	P06	2.0354	12.5	23.4	1,2,3,7,8,13	737.12	22.83	81.6915	00
20001102	D019	P07	2.2719	12.5	23.4	1,2,3,7,8,13	737.12	22.83	91.1860	00
20010321	D0T1	P04	1.7425	12.0	22.7	1,2,3,7,8,13	737.13	22.83	69.9374	00
20010321	D0T1	P06	2.0353	12.0	22.7	1,2,3,7,8,13	737.13	22.83	81.6915	00
20010321	D0T1	P07	2.2719	12.0	22.7	1,2,3,7,8,13	737.13	22.83	91.1861	00
20010322	D020	P03	1.6348	10.0	22.7	1,2,3,7,8,13	737.12	22.82	65.6192	00
20010322	D020	P04	1.7425	10.0	22.7	1,2,3,7,8,13	737.12	22.82	69.9396	00
20010322	D020	P05	1.8332	10.0	22.7	1,2,3,7,8,13	737.12	22.82	73.5796	00
20010322	D020	P06	2.0353	10.0	22.7	1,2,3,7,8,13	737.12	22.82	81.6941	00
20010322	D020	P07	2.2719	10.0	22.7	1,2,3,7,8,13	737.12	22.82	91.1890	00
20010322	D0T2	P06	2.0353	9.5	22.5	1,2,3,7,8,13	737.13	22.82	81.6943	00
20010322	D0T2	P07	2.2719	9.5	22.5	1,2,3,7,8,13	737.13	22.82	91.1892	00
20010323	D021	P03	1.6348	9.0	22.5	1,2,3,7,8,13	737.13	22.82	65.6193	00
20010323	D021	P04	1.7425	9.0	22.5	1,2,3,7,8,13	737.13	22.82	69.9397	00
20010323	D021	P05	1.8332	9.0	22.5	1,2,3,7,8,13	737.13	22.82	73.5797	00
20010323	D021	P06	2.0353	9.0	22.5	1,2,3,7,8,13	737.13	22.82	81.6942	00
20010323	D021	P07	2.2719	9.0	22.5	1,2,3,7,8,13	737.13	22.82	91.1891	00
20010323	D022	P03	1.6348	9.5	22.7	1,2,3,7,8,13	737.12	22.82	65.6191	00
20010323	D022	P04	1.7425	9.5	22.7	1,2,3,7,8,13	737.12	22.82	69.9395	00
20010323	D022	P05	1.8332	9.5	22.7	1,2,3,7,8,13	737.12	22.82	73.5795	00
20010323	D022	P06	2.0353	9.5	22.7	1,2,3,7,8,13	737.12	22.82	81.6940	00
20010323	D022	P07	2.2719	9.5	22.7	1,2,3,7,8,13	737.12	22.82	91.1889	00
20010709	D023	P03	1.6348	13.0	23.0	1,2,3,7,8,13	737.12	22.82	65.6186	00
20010709	D023	P04	1.7425	13.0	23.0	1,2,3,7,8,13	737.12	22.82	69.9381	00
20010709	D023	P05	1.8331	13.0	23.0	1,2,3,7,8,13	737.12	22.82	73.5783	00
20010709	D023	P06	2.0353	13.0	23.0	1,2,3,7,8,13	737.12	22.82	81.6935	00
20010709	D023	P07	2.2719	13.0	23.0	1,2,3,7,8,13	737.12	22.82	91.1883	00
20010710	D024	P03	1.6348	9.5	23.0	1,2,3,7,8,13	737.12	22.82	65.6183	00
20010710	D024	P04	1.7425	9.5	23.0	1,2,3,7,8,13	737.12	22.82	69.9378	00
20010710	D024	P05	1.8331	9.5	23.0	1,2,3,7,8,13	737.12	22.82	73.5779	00
20010710	D024	P06	2.0353	9.5	23.0	1,2,3,7,8,13	737.12	22.82	81.6931	00
20010710	D024	P07	2.2719	9.5	23.0	1,2,3,7,8,13	737.12	22.82	91.1879	00
20010710	D025	P03	1.6348	10.0	23.0	1,2,3,7,8,13	737.12	22.82	65.6184	00
20010710	D025	P04	1.7425	10.0	23.0	1,2,3,7,8,13	737.12	22.82	69.9378	00
20010710	D025	P05	1.8331	10.0	23.0	1,2,3,7,8,13	737.12	22.82	73.5780	00
20010710	D025	P06	2.0353	10.0	23.0	1,2,3,7,8,13	737.12	22.82	81.6931	00
20010710	D025	P07	2.2719	10.0	23.0	1,2,3,7,8,13	737.12	22.82	91.1879	00
20010711	D026	P03	1.6348	8.9	23.0	1,2,3,7,8,13	737.12	22.82	65.6183	00
20010711	D026	P04	1.7425	8.9	23.0	1,2,3,7,8,13	737.12	22.82	69.9377	00
20010711	D026	P05	1.8331	8.9	23.0	1,2,3,7,8,13	737.12	22.82	73.5779	00
20010711	D026	P06	2.0353	8.9	23.0	1,2,3,7,8,13	737.12	22.82	81.6930	00
20010711	D026	P07	2.2719	8.9	23.0	1,2,3,7,8,13	737.12	22.82	91.1878	00
20010711	D027	P03	1.6348	9.4	23.0	1,2,3,7,8,13	737.12	22.82	65.6183	00
20010711	D027	P04	1.7425	9.4	23.0	1,2,3,7,8,13	737.12	22.82	69.9378	00
20010711	D027	P05	1.8331	9.4	23.0	1,2,3,7,8,13	737.12	22.82	73.5779	00
20010711	D027	P06	2.0353	9.4	23.0	1,2,3,7,8,13	737.12	22.82	81.6930	00
20010711	D027	P07	2.2719	9.4	23.0	1,2,3,7,8,13	737.12	22.82	91.1878	00
20010712	D028	P03	1.6348	5.6	23.0	1,2,7,9,12	498.50	22.82	44.3038	00
20010712	D028	P04	1.7425	5.6	23.0	1,2,7,9,12	498.50	22.82	47.2202	00
20010712	D028	P05	1.8331	5.6	23.0	1,2,7,9,12	498.50	22.82	49.6779	00
20010712	D028	P06	2.0353	5.6	23.0	1,2,7,9,12	498.50	22.82	55.1570	00
20010712	D028	P07	2.2719	5.6	23.0	1,2,7,9,12	498.50	22.82	61.5677	00
20020903	D029	P03	1.6348	6.5	23.1	1,3,7,8,13	518.21	22.07	46.1783	00
20020903	D029	P04	1.7423	6.5	23.1	1,3,7,8,13	518.21	22.07	49.2156	00

Table A3: Plenum Fills using Dead Weight Gauge (DWG), 1999 to 2008. Page 3/8

Date	Fill	Plnm	Vol	BellP	DWGT	DWGMassNos	DWGP	BathT	μ-MolesCO2	Flg
20020903	D029	P05	1.8330	6.5	23.1	1,3,7,8,13	518.21	22.07	51.7779	00
20020903	D029	P06	2.0353	6.5	23.1	1,3,7,8,13	518.21	22.07	57.4908	00
20020903	D029	P07	2.2718	6.5	23.1	1,3,7,8,13	518.21	22.07	64.1728	00
20020904	D030	P03	1.6348	8.5	22.5	1,3,7,8,13	518.21	22.08	46.1773	00
20020904	D030	P04	1.7423	8.5	22.5	1,3,7,8,13	518.21	22.08	49.2146	00
20020904	D030	P05	1.8330	8.5	22.5	1,3,7,8,13	518.21	22.08	51.7768	00
20020904	D030	P06	2.0353	8.5	22.5	1,3,7,8,13	518.21	22.08	57.4895	00
20020904	D030	P07	2.2718	8.5	22.5	1,3,7,8,13	518.21	22.08	64.1714	00
20020904	D031	P03	1.6348	9.5	23.0	1,2,3,7,8,13	737.12	22.09	65.7814	00
20020904	D031	P04	1.7423	9.5	23.0	1,2,3,7,8,13	737.12	22.09	70.1081	00
20020904	D031	P05	1.8330	9.5	23.0	1,2,3,7,8,13	737.12	22.09	73.7581	00
20020904	D031	P06	2.0353	9.5	23.0	1,2,3,7,8,13	737.12	22.09	81.8961	00
20020904	D031	P07	2.2718	9.5	23.0	1,2,3,7,8,13	737.12	22.09	91.4147	00
20020905	D032	P03	1.6348	10.0	23.4	1,2,3,7,8,13	737.12	22.08	65.7833	00
20020905	D032	P04	1.7423	10.0	23.4	1,2,3,7,8,13	737.12	22.08	70.1101	00
20020905	D032	P05	1.8330	10.0	23.4	1,2,3,7,8,13	737.12	22.08	73.7602	00
20020905	D032	P06	2.0353	10.0	23.4	1,2,3,7,8,13	737.12	22.08	81.8985	00
20020905	D032	P07	2.2718	10.0	23.4	1,2,3,7,8,13	737.12	22.08	91.4174	00
20020905	D033	P03	1.6348	9.0	23.0	1,2,3,7,8,13	737.12	22.09	65.7813	00
20020905	D033	P04	1.7423	9.0	23.0	1,2,3,7,8,13	737.12	22.09	70.1081	00
20020905	D033	P05	1.8330	9.0	23.0	1,2,3,7,8,13	737.12	22.09	73.7580	00
20020905	D033	P06	2.0353	9.0	23.0	1,2,3,7,8,13	737.12	22.09	81.8961	00
20020905	D033	P07	2.2718	9.0	23.0	1,2,3,7,8,13	737.12	22.09	91.4146	00
20020906	D034	P03	1.6348	12.8	23.1	1,2,3,7,8,13	737.12	22.10	65.7793	00
20020906	D034	P04	1.7423	12.8	23.1	1,2,3,7,8,13	737.12	22.10	70.1059	00
20020906	D034	P05	1.8330	12.8	23.1	1,2,3,7,8,13	737.12	22.10	73.7557	00
20020906	D034	P06	2.0353	12.8	23.1	1,2,3,7,8,13	737.12	22.10	81.8935	00
20020906	D034	P07	2.2718	12.8	23.1	1,2,3,7,8,13	737.12	22.10	91.4118	00
20030627	D035	P03	1.6348	10.9	23.6	1,2,3,7,8,13	737.12	22.04	65.7908	00
20030627	D035	P04	1.7422	10.9	23.6	1,2,3,7,8,13	737.12	22.04	70.1158	00
20030627	D035	P05	1.8329	10.9	23.6	1,2,3,7,8,13	737.12	22.04	73.7669	00
20030627	D035	P06	2.0352	10.9	23.6	1,2,3,7,8,13	737.12	22.04	81.9080	00
20030627	D035	P07	2.2718	10.9	23.6	1,2,3,7,8,13	737.12	22.04	91.4281	00
20030701	D036	P03	1.6348	12.6	23.0	1,2,3,7,8,13	737.12	22.09	65.7802	00
20030701	D036	P04	1.7422	12.6	23.0	1,2,3,7,8,13	737.12	22.09	70.1045	00
20030701	D036	P05	1.8329	12.6	23.0	1,2,3,7,8,13	737.12	22.09	73.7549	00
20030701	D036	P06	2.0352	12.6	23.0	1,2,3,7,8,13	737.12	22.09	81.8948	00
20030701	D036	P07	2.2718	12.6	23.0	1,2,3,7,8,13	737.12	22.09	91.4134	00
20030701	D037	P03	1.6348	9.5	23.7	1,2,3,7,8,13	737.11	22.08	65.7815	00
20030701	D037	P04	1.7422	9.5	23.7	1,2,3,7,8,13	737.11	22.08	70.1058	00
20030701	D037	P05	1.8329	9.5	23.7	1,2,3,7,8,13	737.11	22.08	73.7564	00
20030701	D037	P06	2.0352	9.5	23.7	1,2,3,7,8,13	737.11	22.08	81.8964	00
20030701	D037	P07	2.2718	9.5	23.7	1,2,3,7,8,13	737.11	22.08	91.4152	00
20030702	D038	P03	1.6348	11.9	23.1	1,2,3,7,8,13	737.12	22.06	65.7869	00
20030702	D038	P04	1.7422	11.9	23.1	1,2,3,7,8,13	737.12	22.06	70.1115	00
20030702	D038	P05	1.8329	11.9	23.1	1,2,3,7,8,13	737.12	22.06	73.7624	00
20030702	D038	P06	2.0352	11.9	23.1	1,2,3,7,8,13	737.12	22.06	81.9030	00
20030702	D038	P07	2.2718	11.9	23.1	1,2,3,7,8,13	737.12	22.06	91.4226	00
20030702	D039	P03	1.6348	8.9	23.8	1,2,3,7,8,13	737.11	22.08	65.7814	00
20030702	D039	P04	1.7422	8.9	23.8	1,2,3,7,8,13	737.11	22.08	70.1057	00
20030702	D039	P05	1.8329	8.9	23.8	1,2,3,7,8,13	737.11	22.08	73.7562	00
20030702	D039	P06	2.0352	8.9	23.8	1,2,3,7,8,13	737.11	22.08	81.8962	00
20030702	D039	P07	2.2718	8.9	23.8	1,2,3,7,8,13	737.11	22.08	91.4149	00
20030703	D040	P03	1.6348	9.5	23.3	1,2,3,7,8,13	737.12	22.07	65.7842	00
20030703	D040	P04	1.7422	9.5	23.3	1,2,3,7,8,13	737.12	22.07	70.1087	00
20030703	D040	P05	1.8329	9.5	23.3	1,2,3,7,8,13	737.12	22.07	73.7594	00
20030703	D040	P06	2.0352	9.5	23.3	1,2,3,7,8,13	737.12	22.07	81.8997	00
20030703	D040	P07	2.2718	9.5	23.3	1,2,3,7,8,13	737.12	22.07	91.4188	00
20030703	D041	P03	1.6348	8.9	23.4	1,2,3,7,8,13	737.12	22.06	65.7863	00
20030703	D041	P04	1.7422	8.9	23.4	1,2,3,7,8,13	737.12	22.06	70.1109	00
20030703	D041	P05	1.8329	8.9	23.4	1,2,3,7,8,13	737.12	22.06	73.7617	00
20030703	D041	P06	2.0352	8.9	23.4	1,2,3,7,8,13	737.12	22.06	81.9023	00
20030703	D041	P07	2.2718	8.9	23.4	1,2,3,7,8,13	737.12	22.06	91.4218	00
20041213	D042	P01	1.2967	17.0	22.2	1,2,3,7,8,13	737.14	22.21	52.1593	00
20041213	D042	P02	1.4609	17.0	22.2	1,2,3,7,8,13	737.14	22.21	58.7615	00
20041213	D042	P03	1.6347	17.0	22.2	1,2,3,7,8,13	737.14	22.21	65.7525	01
20041213	D042	P04	1.7420	17.0	22.2	1,2,3,7,8,13	737.14	22.21	70.0705	00
20041213	D042	P05	1.8328	17.0	22.2	1,2,3,7,8,13	737.14	22.21	73.7204	00
20041213	D042	P06	2.0352	17.0	22.2	1,2,3,7,8,13	737.14	22.21	81.8603	00
20041213	D042	P07	2.2717	17.0	22.2	1,2,3,7,8,13	737.14	22.21	91.3751	00
20041214	D043	P01	1.2967	17.0	22.3	1,2,3,7,8,13	737.14	22.21	52.1592	00
20041214	D043	P02	1.4609	17.0	22.3	1,2,3,7,8,13	737.14	22.21	58.7614	00
20041214	D043	P03	1.6347	17.0	22.3	1,2,3,7,8,13	737.14	22.21	65.7524	00

Table A3: Plenum Fills using Dead Weight Gauge (DWG), 1999 to 2008. Page 4/8

Date	Fill	Plnm	Vol	BellP	DWGT	DWGMassNos	DWGP	BathT	μ-MolesCO2	Flg
20041214	D043	P04	1.7420	17.0	22.3	1,2,3,7,8,13	737.14	22.21	70.0704	00
20041214	D043	P05	1.8328	17.0	22.3	1,2,3,7,8,13	737.14	22.21	73.7203	00
20041214	D043	P06	2.0352	17.0	22.3	1,2,3,7,8,13	737.14	22.21	81.8601	00
20041214	D043	P07	2.2717	17.0	22.3	1,2,3,7,8,13	737.14	22.21	91.3750	00
20041214	D044	P01	1.2967	10.0	22.5	1,2,3,7,8,13	737.13	22.21	52.1585	00
20041214	D044	P02	1.4609	10.0	22.5	1,2,3,7,8,13	737.13	22.21	58.7607	00
20041214	D044	P03	1.6347	10.0	22.5	1,2,3,7,8,13	737.13	22.21	65.7515	00
20041214	D044	P04	1.7420	10.0	22.5	1,2,3,7,8,13	737.13	22.21	70.0695	00
20041214	D044	P05	1.8328	10.0	22.5	1,2,3,7,8,13	737.13	22.21	73.7194	00
20041214	D044	P06	2.0352	10.0	22.5	1,2,3,7,8,13	737.13	22.21	81.8591	00
20041214	D044	P07	2.2717	10.0	22.5	1,2,3,7,8,13	737.13	22.21	91.3738	00
20041215	D045	P01	1.2967	15.0	22.6	1,2,3,7,8,13	737.13	22.21	52.1590	00
20041215	D045	P02	1.4609	15.0	22.6	1,2,3,7,8,13	737.13	22.21	58.7612	00
20041215	D045	P03	1.6347	15.0	22.6	1,2,3,7,8,13	737.13	22.21	65.7521	00
20041215	D045	P04	1.7420	15.0	22.6	1,2,3,7,8,13	737.13	22.21	70.0701	00
20041215	D045	P05	1.8328	15.0	22.6	1,2,3,7,8,13	737.13	22.21	73.7200	00
20041215	D045	P06	2.0352	15.0	22.6	1,2,3,7,8,13	737.13	22.21	81.8598	00
20041215	D045	P07	2.2717	15.0	22.6	1,2,3,7,8,13	737.13	22.21	91.3746	00
20041215	D046	P01	1.2967	11.0	22.4	1,2,3,7,8,13	737.13	22.21	52.1585	00
20041215	D046	P02	1.4609	11.0	22.4	1,2,3,7,8,13	737.13	22.21	58.7607	00
20041215	D046	P03	1.6347	11.0	22.4	1,2,3,7,8,13	737.13	22.21	65.7515	00
20041215	D046	P04	1.7420	11.0	22.4	1,2,3,7,8,13	737.13	22.21	70.0695	00
20041215	D046	P05	1.8328	11.0	22.4	1,2,3,7,8,13	737.13	22.21	73.7193	00
20041215	D046	P06	2.0352	11.0	22.4	1,2,3,7,8,13	737.13	22.21	81.8591	00
20041215	D046	P07	2.2717	11.0	22.4	1,2,3,7,8,13	737.13	22.21	91.3738	00
20041216	D047	P01	1.2967	13.0	22.5	1,2,3,7,8,13	737.13	22.21	52.1589	00
20041216	D047	P02	1.4609	13.0	22.5	1,2,3,7,8,13	737.13	22.21	58.7611	00
20041216	D047	P03	1.6347	13.0	22.5	1,2,3,7,8,13	737.13	22.21	65.7520	00
20041216	D047	P04	1.7420	13.0	22.5	1,2,3,7,8,13	737.13	22.21	70.0700	00
20041216	D047	P05	1.8328	13.0	22.5	1,2,3,7,8,13	737.13	22.21	73.7199	00
20041216	D047	P06	2.0352	13.0	22.5	1,2,3,7,8,13	737.13	22.21	81.8597	00
20041216	D047	P07	2.2717	13.0	22.5	1,2,3,7,8,13	737.13	22.21	91.3745	00
20041216	D048	P01	1.2967	11.0	22.3	1,2,3,7,8,13	737.13	22.21	52.1589	00
20041216	D048	P02	1.4609	11.0	22.3	1,2,3,7,8,13	737.13	22.21	58.7612	00
20041216	D048	P03	1.6347	11.0	22.3	1,2,3,7,8,13	737.13	22.21	65.7520	00
20041216	D048	P04	1.7420	11.0	22.3	1,2,3,7,8,13	737.13	22.21	70.0700	00
20041216	D048	P05	1.8328	11.0	22.3	1,2,3,7,8,13	737.13	22.21	73.7199	00
20041216	D048	P06	2.0352	11.0	22.3	1,2,3,7,8,13	737.13	22.21	81.8598	00
20041216	D048	P07	2.2717	11.0	22.3	1,2,3,7,8,13	737.13	22.21	91.3745	00
20050503	D049	P03	1.6347	10.5	22.0	1,2,3,7,8,13	737.13	22.33	65.7245	00
20050503	D049	P04	1.7420	10.5	22.0	1,2,3,7,8,13	737.13	22.33	70.0396	00
20050503	D049	P05	1.8327	10.5	22.0	1,2,3,7,8,13	737.13	22.33	73.6882	00
20050503	D049	P06	2.0351	10.5	22.0	1,2,3,7,8,13	737.13	22.33	81.8255	00
20050503	D049	P07	2.2717	10.5	22.0	1,2,3,7,8,13	737.13	22.33	91.3363	00
20050615	D050	P03	1.6347	13.8	22.0	1,2,3,7,8,13	737.14	22.32	65.7248	00
20050615	D050	P04	1.7420	13.8	22.0	1,2,3,7,8,13	737.14	22.32	70.0395	00
20050615	D050	P05	1.8327	13.8	22.0	1,2,3,7,8,13	737.14	22.32	73.6883	00
20050615	D050	P06	2.0351	13.8	22.0	1,2,3,7,8,13	737.14	22.32	81.8259	00
20050615	D050	P07	2.2717	13.8	22.0	1,2,3,7,8,13	737.14	22.32	91.3368	00
20050616	D051	P03	1.6347	11.4	22.0	1,2,3,7,8,13	737.13	22.32	65.7246	00
20050616	D051	P04	1.7420	11.4	22.0	1,2,3,7,8,13	737.13	22.32	70.0393	00
20050616	D051	P05	1.8327	11.4	22.0	1,2,3,7,8,13	737.13	22.32	73.6880	00
20050616	D051	P06	2.0351	11.4	22.0	1,2,3,7,8,13	737.13	22.32	81.8256	00
20050616	D051	P07	2.2717	11.4	22.0	1,2,3,7,8,13	737.13	22.32	91.3365	00
20050617	D052	P03	1.6347	11.1	21.9	1,2,3,7,8,13	737.13	22.32	65.7251	00
20050617	D052	P04	1.7420	11.1	21.9	1,2,3,7,8,13	737.13	22.32	70.0398	00
20050617	D052	P05	1.8327	11.1	21.9	1,2,3,7,8,13	737.13	22.32	73.6886	00
20050617	D052	P06	2.0351	11.1	21.9	1,2,3,7,8,13	737.13	22.32	81.8263	00
20050617	D052	P07	2.2717	11.1	21.9	1,2,3,7,8,13	737.13	22.32	91.3372	00
20050620	D053	P01	1.2967	11.5	21.9	1,2,3,7,8,13	737.14	22.33	52.1370	00
20050620	D053	P02	1.4609	11.5	21.9	1,2,3,7,8,13	737.14	22.33	58.7366	00
20050620	D053	P03	1.6347	11.5	21.9	1,2,3,7,8,13	737.14	22.33	65.7245	00
20050620	D053	P04	1.7420	11.5	21.9	1,2,3,7,8,13	737.14	22.33	70.0391	00
20050620	D053	P05	1.8327	11.5	21.9	1,2,3,7,8,13	737.14	22.33	73.6878	00
20050620	D053	P06	2.0351	11.5	21.9	1,2,3,7,8,13	737.14	22.33	81.8254	00
20050620	D053	P07	2.2717	11.5	21.9	1,2,3,7,8,13	737.14	22.33	91.3363	00
20050707	D054	P01	1.2967	12.9	22.4	1,2,3,7,8,13	737.13	22.32	52.1368	00
20050707	D054	P02	1.4609	12.9	22.4	1,2,3,7,8,13	737.13	22.32	58.7364	00
20050707	D054	P03	1.6347	12.9	22.4	1,2,3,7,8,13	737.13	22.32	65.7242	00
20050707	D054	P04	1.7420	12.9	22.4	1,2,3,7,8,13	737.13	22.32	70.0387	00
20050707	D054	P05	1.8327	12.9	22.4	1,2,3,7,8,13	737.13	22.32	73.6875	00
20050707	D054	P06	2.0351	12.9	22.4	1,2,3,7,8,13	737.13	22.32	81.8252	00
20050707	D054	P07	2.2717	12.9	22.4	1,2,3,7,8,13	737.13	22.32	91.3360	00

Table A3: Plenum Fills using Dead Weight Gauge (DWG), 1999 to 2008. Page 5/8

Date	Fill	Plnm	Vol	BellP	DWGT	DWGMassNos	DWGP	BathT	μ-MolesCO2	Flg
20050708	D055	P01	1.2967	11.9	21.8	1,2,3,7,8,13	737.14	22.32	52.1374	00
20050708	D055	P02	1.4609	11.9	21.8	1,2,3,7,8,13	737.14	22.32	58.7370	00
20050708	D055	P03	1.6347	11.9	21.8	1,2,3,7,8,13	737.14	22.32	65.7250	00
20050708	D055	P04	1.7420	11.9	21.8	1,2,3,7,8,13	737.14	22.32	70.0395	00
20050708	D055	P05	1.8327	11.9	21.8	1,2,3,7,8,13	737.14	22.32	73.6883	00
20050708	D055	P06	2.0351	11.9	21.8	1,2,3,7,8,13	737.14	22.32	81.8261	00
20050708	D055	P07	2.2717	11.9	21.8	1,2,3,7,8,13	737.14	22.32	91.3370	00
20060109	D056	P01	1.2967	15.1	22.7	1,2,3,7,8,13	737.13	22.30	52.1412	00
20060109	D056	P02	1.4609	15.1	22.7	1,2,3,7,8,13	737.13	22.30	58.7415	00
20060109	D056	P03	1.6346	15.1	22.7	1,2,3,7,8,13	737.13	22.30	65.7298	00
20060109	D056	P04	1.7419	15.1	22.7	1,2,3,7,8,13	737.13	22.30	70.0432	00
20060109	D056	P05	1.8327	15.1	22.7	1,2,3,7,8,13	737.13	22.30	73.6926	00
20060109	D056	P06	2.0351	15.1	22.7	1,2,3,7,8,13	737.13	22.30	81.8322	00
20060109	D056	P07	2.2716	15.1	22.7	1,2,3,7,8,13	737.13	22.30	91.3439	00
20060110	D057	P01	1.2967	16.0	22.1	1,2,3,7,8,13	737.14	22.30	52.1415	00
20060110	D057	P02	1.4609	16.0	22.1	1,2,3,7,8,13	737.14	22.30	58.7419	00
20060110	D057	P03	1.6346	16.0	22.1	1,2,3,7,8,13	737.14	22.30	65.7303	00
20060110	D057	P04	1.7419	16.0	22.1	1,2,3,7,8,13	737.14	22.30	70.0437	00
20060110	D057	P05	1.8327	16.0	22.1	1,2,3,7,8,13	737.14	22.30	73.6931	00
20060110	D057	P06	2.0351	16.0	22.1	1,2,3,7,8,13	737.14	22.30	81.8327	00
20060110	D057	P07	2.2716	16.0	22.1	1,2,3,7,8,13	737.14	22.30	91.3445	00
20060111	D058	P01	1.2967	14.3	21.8	1,2,3,7,8,13	737.14	22.30	52.1415	00
20060111	D058	P02	1.4609	14.3	21.8	1,2,3,7,8,13	737.14	22.30	58.7418	00
20060111	D058	P03	1.6346	14.3	21.8	1,2,3,7,8,13	737.14	22.30	65.7302	00
20060111	D058	P04	1.7419	14.3	21.8	1,2,3,7,8,13	737.14	22.30	70.0436	00
20060111	D058	P05	1.8327	14.3	21.8	1,2,3,7,8,13	737.14	22.30	73.6930	00
20060111	D058	P06	2.0351	14.3	21.8	1,2,3,7,8,13	737.14	22.30	81.8326	00
20060111	D058	P07	2.2716	14.3	21.8	1,2,3,7,8,13	737.14	22.30	91.3444	00
20060111	D059	P01	1.2967	12.9	21.9	1,2,3,7,8,13	737.14	22.30	52.1411	00
20060111	D059	P02	1.4609	12.9	21.9	1,2,3,7,8,13	737.14	22.30	58.7414	00
20060111	D059	P03	1.6346	12.9	21.9	1,2,3,7,8,13	737.14	22.30	65.7297	00
20060111	D059	P04	1.7419	12.9	21.9	1,2,3,7,8,13	737.14	22.30	70.0431	00
20060111	D059	P05	1.8327	12.9	21.9	1,2,3,7,8,13	737.14	22.30	73.6925	00
20060111	D059	P06	2.0351	12.9	21.9	1,2,3,7,8,13	737.14	22.30	81.8321	00
20060111	D059	P07	2.2716	12.9	21.9	1,2,3,7,8,13	737.14	22.30	91.3438	00
20060112	D060	P01	1.2967	12.6	21.9	1,2,3,7,8,13	737.14	22.29	52.1422	00
20060112	D060	P01	1.2967	12.6	21.9	1,2,3,7,8,13	737.14	22.29	52.1422	00
20060112	D060	P02	1.4609	12.6	21.9	1,2,3,7,8,13	737.14	22.29	58.7426	00
20060112	D060	P02	1.4609	12.6	21.9	1,2,3,7,8,13	737.14	22.29	58.7426	00
20060112	D060	P03	1.6346	12.6	21.9	1,2,3,7,8,13	737.14	22.29	65.7311	00
20060112	D060	P03	1.6346	12.6	21.9	1,2,3,7,8,13	737.14	22.29	65.7311	00
20060112	D060	P04	1.7419	12.6	21.9	1,2,3,7,8,13	737.14	22.29	70.0445	00
20060112	D060	P04	1.7419	12.6	21.9	1,2,3,7,8,13	737.14	22.29	70.0445	00
20060112	D060	P05	1.8327	12.6	21.9	1,2,3,7,8,13	737.14	22.29	73.6939	00
20060112	D060	P05	1.8327	12.6	21.9	1,2,3,7,8,13	737.14	22.29	73.6939	00
20060112	D060	P06	2.0351	12.6	21.9	1,2,3,7,8,13	737.14	22.29	81.8337	00
20060112	D060	P06	2.0351	12.6	21.9	1,2,3,7,8,13	737.14	22.29	81.8337	00
20060112	D060	P07	2.2716	12.6	21.9	1,2,3,7,8,13	737.14	22.29	91.3456	00
20060112	D060	P07	2.2716	12.6	21.9	1,2,3,7,8,13	737.14	22.29	91.3456	00
20060822	D061	P01	1.2967	18.5	21.5	1,2,3,7,8,13	737.15	22.30	52.1409	00
20060822	D061	P02	1.4608	18.5	21.5	1,2,3,7,8,13	737.15	22.30	58.7413	00
20060822	D061	P03	1.6346	18.5	21.5	1,2,3,7,8,13	737.15	22.30	65.7296	00
20060822	D061	P04	1.7418	18.5	21.5	1,2,3,7,8,13	737.15	22.30	70.0411	00
20060822	D061	P05	1.8326	18.5	21.5	1,2,3,7,8,13	737.15	22.30	73.6909	00
20060822	D061	P06	2.0351	18.5	21.5	1,2,3,7,8,13	737.15	22.30	81.8319	00
20060822	D061	P07	2.2716	18.5	21.5	1,2,3,7,8,13	737.15	22.30	91.3437	00
20060822	D061	P08	2.8010	18.5	21.5	1,2,3,7,8,13	737.15	22.30	112.629	00
20060824	D062	P01	1.2967	15.4	21.2	1,2,3,7,8,13	737.15	22.30	52.1406	00
20060824	D062	P02	1.4608	15.4	21.2	1,2,3,7,8,13	737.15	22.30	58.7410	00
20060824	D062	P03	1.6346	15.4	21.2	1,2,3,7,8,13	737.15	22.30	65.7291	00
20060824	D062	P04	1.7418	15.4	21.2	1,2,3,7,8,13	737.15	22.30	70.0406	00
20060824	D062	P05	1.8326	15.4	21.2	1,2,3,7,8,13	737.15	22.30	73.6904	00
20060824	D062	P06	2.0351	15.4	21.2	1,2,3,7,8,13	737.15	22.30	81.8314	00
20060824	D062	P07	2.2716	15.4	21.2	1,2,3,7,8,13	737.15	22.30	91.3431	00
20060824	D062	P08	2.8010	15.4	21.2	1,2,3,7,8,13	737.15	22.30	112.628	00
20060825	D063	P01	1.2967	14.5	21.4	1,2,3,7,8,13	737.14	22.30	52.1405	00
20060825	D063	P02	1.4608	14.5	21.4	1,2,3,7,8,13	737.14	22.30	58.7409	00
20060825	D063	P03	1.6346	14.5	21.4	1,2,3,7,8,13	737.14	22.30	65.7291	00
20060825	D063	P04	1.7418	14.5	21.4	1,2,3,7,8,13	737.14	22.30	70.0405	00
20060825	D063	P05	1.8326	14.5	21.4	1,2,3,7,8,13	737.14	22.30	73.6903	00
20060825	D063	P06	2.0351	14.5	21.4	1,2,3,7,8,13	737.14	22.30	81.8313	00
20060825	D063	P07	2.2716	14.5	21.4	1,2,3,7,8,13	737.14	22.30	91.3430	00
20060825	D063	P08	2.8010	14.5	21.4	1,2,3,7,8,13	737.14	22.30	112.628	00

Table A3: Plenum Fills using Dead Weight Gauge (DWG), 1999 to 2008. Page 6/8

Date	Fill	Plnm	Vol	BellP	DWGT	DWGMassNos	DWGP	BathT	μ-MolesCO2	Flg
20060825	D064	P01	1.2967	11.3	21.4	1,2,3,7,8,13	737.14	22.30	52.1403	00
20060825	D064	P02	1.4608	11.3	21.4	1,2,3,7,8,13	737.14	22.30	58.7406	00
20060825	D064	P03	1.6346	11.3	21.4	1,2,3,7,8,13	737.14	22.30	65.7288	00
20060825	D064	P04	1.7418	11.3	21.4	1,2,3,7,8,13	737.14	22.30	70.0402	00
20060825	D064	P05	1.8326	11.3	21.4	1,2,3,7,8,13	737.14	22.30	73.6900	00
20060825	D064	P06	2.0351	11.3	21.4	1,2,3,7,8,13	737.14	22.30	81.8309	00
20060825	D064	P07	2.2716	11.3	21.4	1,2,3,7,8,13	737.14	22.30	91.3426	00
20060825	D064	P08	2.8010	11.3	21.4	1,2,3,7,8,13	737.14	22.30	112.628	00
20070419	D065	P01	1.2967	30.5	24.1	1,2,3,7,8,13	737.13	22.29	52.1397	00
20070419	D065	P02	1.4608	30.5	24.1	1,2,3,7,8,13	737.13	22.29	58.7401	00
20070419	D065	P03	1.6346	30.5	24.1	1,2,3,7,8,13	737.13	22.29	65.7281	00
20070419	D065	P04	1.7418	30.5	24.1	1,2,3,7,8,13	737.13	22.29	70.0376	00
20070419	D065	P05	1.8325	30.5	24.1	1,2,3,7,8,13	737.13	22.29	73.6877	00
20070419	D065	P06	2.0350	30.5	24.1	1,2,3,7,8,13	737.13	22.29	81.8301	00
20070419	D065	P07	2.2716	30.5	24.1	1,2,3,7,8,13	737.13	22.29	91.3418	00
20070419	D065	P08	2.8010	30.5	24.1	1,2,3,7,8,13	737.13	22.29	112.629	00
20070420	D066	P01	1.2967	38.9	23.9	1,2,3,7,8,13	737.14	22.30	52.1402	00
20070420	D066	P02	1.4608	38.9	23.9	1,2,3,7,8,13	737.14	22.30	58.7408	00
20070420	D066	P03	1.6346	38.9	23.9	1,2,3,7,8,13	737.14	22.30	65.7288	00
20070420	D066	P04	1.7418	38.9	23.9	1,2,3,7,8,13	737.14	22.30	70.0383	00
20070420	D066	P05	1.8325	38.9	23.9	1,2,3,7,8,13	737.14	22.30	73.6885	00
20070420	D066	P06	2.0350	38.9	23.9	1,2,3,7,8,13	737.14	22.30	81.8310	00
20070420	D066	P07	2.2716	38.9	23.9	1,2,3,7,8,13	737.14	22.30	91.3428	00
20070420	D066	P08	2.8010	38.9	23.9	1,2,3,7,8,13	737.14	22.30	112.630	00
20070420	D067	P01	1.2967	26.5	22.3	1,2,3,7,8,13	737.15	22.30	52.1406	00
20070420	D067	P02	1.4608	26.5	22.3	1,2,3,7,8,13	737.15	22.30	58.7412	00
20070420	D067	P03	1.6346	26.5	22.3	1,2,3,7,8,13	737.15	22.30	65.7293	00
20070420	D067	P04	1.7418	26.5	22.3	1,2,3,7,8,13	737.15	22.30	70.0388	00
20070420	D067	P05	1.8325	26.5	22.3	1,2,3,7,8,13	737.15	22.30	73.6890	00
20070420	D067	P06	2.0350	26.5	22.3	1,2,3,7,8,13	737.15	22.30	81.8316	00
20070420	D067	P07	2.2716	26.5	22.3	1,2,3,7,8,13	737.15	22.30	91.3435	00
20070420	D067	P08	2.8010	26.5	22.3	1,2,3,7,8,13	737.15	22.30	112.630	00
20070503	D068	L03	12.6519	29.2	22.4	1,9,11,12,14	99.83	22.30	68.5947	00
20070503	D068	L04	13.6812	29.2	22.4	1,9,11,12,14	99.83	22.30	74.1749	00
20070503	D068	L05	16.2352	29.2	22.4	1,9,11,12,14	99.83	22.30	88.0222	00
20070503	D068	L07	18.2915	29.2	22.4	1,9,11,12,14	99.83	22.30	99.1708	00
20070504	D069	L03	12.6519	27.8	21.9	1,9,11,12,14	99.83	22.29	68.5947	00
20070504	D069	L04	13.6812	27.8	21.9	1,9,11,12,14	99.83	22.29	74.1750	00
20070504	D069	L05	16.2352	27.8	21.9	1,9,11,12,14	99.83	22.29	88.0222	00
20070504	D069	L07	18.2915	27.8	21.9	1,9,11,12,14	99.83	22.29	99.1708	00
20070515	D070	L02	11.0960	13.9	22.9	1,9,11,12,14	99.81	22.29	60.1497	00
20070515	D070	L04	13.6812	13.9	22.9	1,9,11,12,14	99.81	22.29	74.1633	00
20070515	D070	L05	16.2352	13.9	22.9	1,9,11,12,14	99.81	22.29	88.0083	00
20070515	D070	L06	16.2742	13.9	22.9	1,9,11,12,14	99.81	22.29	88.2195	00
20070515	D070	L07	18.2915	13.9	22.9	1,9,11,12,14	99.81	22.29	99.1552	00
20070515	D070	L08	20.0336	13.9	22.9	1,9,11,12,14	99.81	22.29	108.599	00
20070516	D071	L02	11.0960	18.8	22.6	1,9,11,12,14	99.82	22.29	60.1529	00
20070516	D071	L04	13.6812	18.8	22.6	1,9,11,12,14	99.82	22.29	74.1673	00
20070516	D071	L05	16.2352	18.8	22.6	1,9,11,12,14	99.82	22.29	88.0130	00
20070516	D071	L06	16.2742	18.8	22.6	1,9,11,12,14	99.82	22.29	88.2242	00
20070516	D071	L07	18.2915	18.8	22.6	1,9,11,12,14	99.82	22.29	99.1605	00
20070516	D071	L08	20.0336	18.8	22.6	1,9,11,12,14	99.82	22.29	108.605	00
20070718	D072	L01	7.4734	24.5	22.6	1,9,11,12,14	99.82	22.31	40.5146	00
20070718	D072	L02	11.0960	24.5	22.6	1,9,11,12,14	99.82	22.31	60.1535	00
20070718	D072	L04	13.6812	24.5	22.6	1,9,11,12,14	99.82	22.31	74.1680	00
20070718	D072	L06	16.2742	24.5	22.6	1,9,11,12,14	99.82	22.31	88.2250	00
20070718	D072	L07	18.2915	24.5	22.6	1,9,11,12,14	99.82	22.31	99.1615	00
20070718	D072	L08	20.0336	24.5	22.6	1,9,11,12,14	99.82	22.31	108.606	00
20070720	D073	L01	7.4734	22.7	22.8	1,9,11,12,14	99.82	22.31	40.5137	00
20070720	D073	L02	11.0960	22.7	22.8	1,9,11,12,14	99.82	22.31	60.1522	00
20070720	D073	L04	13.6812	22.7	22.8	1,9,11,12,14	99.82	22.31	74.1664	00
20070720	D073	L06	16.2742	22.7	22.8	1,9,11,12,14	99.82	22.31	88.2232	00
20070720	D073	L07	18.2915	22.7	22.8	1,9,11,12,14	99.82	22.31	99.1594	00
20070720	D073	L08	20.0336	22.7	22.8	1,9,11,12,14	99.82	22.31	108.603	00
20070720	D074	L01	7.4734	11.2	23.2	1,9,11,12,14	99.81	22.31	40.5088	00
20070720	D074	L02	11.0960	11.2	23.2	1,9,11,12,14	99.81	22.31	60.1449	00
20070720	D074	L04	13.6812	11.2	23.2	1,9,11,12,14	99.81	22.31	74.1574	00
20070720	D074	L06	16.2742	11.2	23.2	1,9,11,12,14	99.81	22.31	88.2125	00
20070720	D074	L07	18.2915	11.2	23.2	1,9,11,12,14	99.81	22.31	99.1474	00
20070720	D074	L07	18.2915	11.2	23.2	1,9,11,12,14	99.81	22.31	99.1474	00
20070913	D075	L01	7.4734	25.0	23.5	1,9,11,12,14	99.82	22.31	40.5145	00
20070913	D076	L01	7.4734	23.3	24.2	1,7	145.78	22.31	59.1878	00
20070913	D077	L01	7.4734	13.5	23.8	1,7,8	211.45	22.31	85.8863	00

Table A3: Plenum Fills using Dead Weight Gauge (DWG), 1999 to 2008. Page 7/8

Date	Fill	Plnm	Vol	BellP	DWGT	DWGMassNos	DWGP	BathT	μ-MolesCO2	Flg
20070913	D078	L01	7.4734	15.0	24.0	1,7,8,9	255.23	22.31	103.701	00
20070921	D079	L01	7.4734	15.4	24.4	1,9,11,12,14	99.81	22.30	40.5102	00
20070921	D080	L01	7.4734	17.8	24.8	1,7	145.78	22.30	59.1853	00
20070921	D081	L01	7.4734	22.1	24.6	1,7,8	211.45	22.30	85.8891	00
20070921	D082	L01	7.4734	24.5	22.3	1,7,8,9	255.24	22.30	103.708	00
20071009	D083	L02	11.0960	17.4	24.3	1,9	80.11	22.31	48.2659	00
20071009	D084	L02	11.0960	19.6	24.0	1,9,11,12,14	99.81	22.31	60.1496	00
20071009	D085	L02	11.0960	15.0	24.5	1,8,9	145.78	22.31	87.8739	00
20071009	D086	L02	11.0960	14.9	24.3	1,7,8	211.45	22.31	127.518	00
20080129	D087	L01	7.4734	8.5	24.6	1,9,11,12,14	99.80	22.27	40.5116	00
20080129	D087	L02	11.0960	8.5	24.6	1,9,11,12,14	99.80	22.27	60.1489	00
20080129	D087	L03	12.6519	8.5	24.6	1,9,11,12,14	99.80	22.27	68.5831	00
20080129	D087	L04	13.6812	8.5	24.6	1,9,11,12,14	99.80	22.27	74.1624	00
20080129	D087	L05	16.2352	8.5	24.6	1,9,11,12,14	99.80	22.27	88.0073	00
20080129	D087	L06	16.2742	8.5	24.6	1,9,11,12,14	99.80	22.27	88.2184	00
20080129	D087	L07	18.2915	8.5	24.6	1,9,11,12,14	99.80	22.27	99.1540	00
20080129	D087	L08	20.0336	8.5	24.6	1,9,11,12,14	99.80	22.27	108.597	00
20080129	D088	L01	7.4734	8.0	24.3	1,9,11,12,14	99.80	22.27	40.5119	00
20080129	D088	L02	11.0960	8.0	24.3	1,9,11,12,14	99.80	22.27	60.1495	00
20080129	D088	L03	12.6519	8.0	24.3	1,9,11,12,14	99.80	22.27	68.5838	00
20080129	D088	L04	13.6812	8.0	24.3	1,9,11,12,14	99.80	22.27	74.1631	00
20080129	D088	L05	16.2352	8.0	24.3	1,9,11,12,14	99.80	22.27	88.0082	00
20080129	D088	L06	16.2742	8.0	24.3	1,9,11,12,14	99.80	22.27	88.2193	00
20080129	D088	L07	18.2915	8.0	24.3	1,9,11,12,14	99.80	22.27	99.1550	00
20080129	D088	L08	20.0336	8.0	24.3	1,9,11,12,14	99.80	22.27	108.599	00
20080130	D089	L01	7.4734	6.9	24.2	1,9,11,12,14	99.80	22.31	40.5068	00
20080130	D089	L02	11.0960	6.9	24.2	1,9,11,12,14	99.80	22.31	60.1417	00
20080130	D089	L03	12.6519	6.9	24.2	1,9,11,12,14	99.80	22.31	68.5750	00
20080130	D089	L04	13.6812	6.9	24.2	1,9,11,12,14	99.80	22.31	74.1536	00
20080130	D089	L05	16.2352	6.9	24.2	1,9,11,12,14	99.80	22.31	87.9969	00
20080130	D089	L06	16.2742	6.9	24.2	1,9,11,12,14	99.80	22.31	88.2080	00
20080130	D089	L07	18.2915	6.9	24.2	1,9,11,12,14	99.80	22.31	99.1423	00
20080130	D089	L08	20.0336	6.9	24.2	1,9,11,12,14	99.80	22.31	108.585	00
20080130	D090	L01	7.4734	6.7	24.1	1,9,11,12,14	99.80	22.31	40.5067	00
20080130	D090	L02	11.0960	6.7	24.1	1,9,11,12,14	99.80	22.31	60.1417	00
20080130	D090	L03	12.6519	6.7	24.1	1,9,11,12,14	99.80	22.31	68.5749	00
20080130	D090	L04	13.6812	6.7	24.1	1,9,11,12,14	99.80	22.31	74.1536	00
20080130	D090	L05	16.2352	6.7	24.1	1,9,11,12,14	99.80	22.31	87.9968	00
20080130	D090	L06	16.2742	6.7	24.1	1,9,11,12,14	99.80	22.31	88.2079	00
20080130	D090	L07	18.2915	6.7	24.1	1,9,11,12,14	99.80	22.31	99.1422	00
20080130	D090	L08	20.0336	6.7	24.1	1,9,11,12,14	99.80	22.31	108.585	00
20080131	D091	L01	7.4734	6.3	23.8	1,9,11,12,14	99.80	22.26	40.5128	00
20080131	D091	L02	11.0960	6.3	23.8	1,9,11,12,14	99.80	22.26	60.1507	00
20080131	D091	L03	12.6519	6.3	23.8	1,9,11,12,14	99.80	22.26	68.5852	00
20080131	D091	L04	13.6812	6.3	23.8	1,9,11,12,14	99.80	22.26	74.1647	00
20080131	D091	L05	16.2352	6.3	23.8	1,9,11,12,14	99.80	22.26	88.0100	00
20080131	D091	L06	16.2742	6.3	23.8	1,9,11,12,14	99.80	22.26	88.2211	00
20080131	D091	L07	18.2915	6.3	23.8	1,9,11,12,14	99.80	22.26	99.1571	00
20080131	D091	L08	20.0336	6.3	23.8	1,9,11,12,14	99.80	22.26	108.601	00
20080214	E001	L02	11.0960	21.0	23.8	1,2,3,4,9	736.83	22.26	446.046	00
20080414	E002	P09	51.4338	27.2	24.6	1,2,3,4,9	736.83	22.29	2067.40	00
20080421	E003	P11	270.6862	21.0	24.7	1,2,3,4,9	736.82	22.29	10880.2	00
20080622	E004	P12	1011.0850	28.6	24.6	1,2,3,7,11,12	601.11	22.28	33124.4	00
20081201	D092	L01	7.4734	20.9	23.4	1,9,11,12,14	99.82	22.30	40.5131	00
20081201	D092	L02	11.0960	20.9	23.4	1,9,11,12,14	99.82	22.30	60.1510	00
20081201	D092	L03	12.6519	20.9	23.4	1,9,11,12,14	99.82	22.30	68.5856	00
20081201	D092	L04	13.6812	20.9	23.4	1,9,11,12,14	99.82	22.30	74.1652	00
20081201	D092	L05	16.2352	20.9	23.4	1,9,11,12,14	99.82	22.30	88.0106	00
20081201	D092	L06	16.2742	20.9	23.4	1,9,11,12,14	99.82	22.30	88.2217	00
20081201	D092	L07	18.2915	20.9	23.4	1,9,11,12,14	99.82	22.30	99.1577	00
20081201	D092	L08	20.0336	20.9	23.4	1,9,11,12,14	99.82	22.30	108.602	00
20081202	D093	L01	7.4734	10.6	23.9	1,9,11,12,14	99.81	22.30	40.5086	00
20081202	D093	L02	11.0960	10.6	23.9	1,9,11,12,14	99.81	22.30	60.1443	00
20081202	D093	L03	12.6519	10.6	23.9	1,9,11,12,14	99.81	22.30	68.5780	00
20081202	D093	L04	13.6812	10.6	23.9	1,9,11,12,14	99.81	22.30	74.1569	00
20081202	D093	L05	16.2352	10.6	23.9	1,9,11,12,14	99.81	22.30	88.0008	00
20081202	D093	L06	16.2742	10.6	23.9	1,9,11,12,14	99.81	22.30	88.2119	00
20081202	D093	L07	18.2915	10.6	23.9	1,9,11,12,14	99.81	22.30	99.1467	00
20081202	D093	L08	20.0336	10.6	23.9	1,9,11,12,14	99.81	22.30	108.590	00
20081202	D094	L01	7.4734	10.1	24.1	1,9,11,12,14	99.80	22.30	40.5084	00
20081202	D094	L02	11.0960	10.1	24.1	1,9,11,12,14	99.80	22.30	60.1440	00
20081202	D094	L03	12.6519	10.1	24.1	1,9,11,12,14	99.80	22.30	68.5777	00
20081202	D094	L04	13.6812	10.1	24.1	1,9,11,12,14	99.80	22.30	74.1566	00

Table A3: Plenum Fills using Dead Weight Gauge (DWG), 1999 to 2008. Page 8/8

Date	Fill	Plnm	Vol	BellP	DWGT	DWGMassNos	DWGP	BathT	μ-MolesCO2	Flg
20081202	D094	L05	16.2352	10.1	24.1	1,9,11,12,14	99.80	22.30	88.0004	00
20081202	D094	L06	16.2742	10.1	24.1	1,9,11,12,14	99.80	22.30	88.2115	00
20081202	D094	L07	18.2915	10.1	24.1	1,9,11,12,14	99.80	22.30	99.1463	00
20081202	D094	L08	20.0336	10.1	24.1	1,9,11,12,14	99.80	22.30	108.589	00
20081203	D095	L01	7.4734	8.7	24.0	1,9,11,12,14	99.80	22.30	40.5079	00
20081203	D095	L02	11.0960	8.7	24.0	1,9,11,12,14	99.80	22.30	60.1433	00
20081203	D095	L03	12.6519	8.7	24.0	1,9,11,12,14	99.80	22.30	68.5769	00
20081203	D095	L04	13.6812	8.7	24.0	1,9,11,12,14	99.80	22.30	74.1557	00
20081203	D095	L05	16.2352	8.7	24.0	1,9,11,12,14	99.80	22.30	87.9993	00
20081203	D095	L06	16.2742	8.7	24.0	1,9,11,12,14	99.80	22.30	88.2104	00
20081203	D095	L07	18.2915	8.7	24.0	1,9,11,12,14	99.80	22.30	99.1450	00
20081203	D095	L08	20.0336	8.7	24.0	1,9,11,12,14	99.80	22.30	108.588	00
20081203	D096	L01	7.4734	8.7	26.0	1,9,11,12,14	99.80	22.30	40.5067	00
20081203	D096	L02	11.0960	8.7	26.0	1,9,11,12,14	99.80	22.30	60.1415	00
20081203	D096	L03	12.6519	8.7	26.0	1,9,11,12,14	99.80	22.30	68.5748	00
20081203	D096	L04	13.6812	8.7	26.0	1,9,11,12,14	99.80	22.30	74.1535	00
20081203	D096	L05	16.2352	8.7	26.0	1,9,11,12,14	99.80	22.30	87.9967	00
20081203	D096	L06	16.2742	8.7	26.0	1,9,11,12,14	99.80	22.30	88.2078	00
20081203	D096	L07	18.2915	8.7	26.0	1,9,11,12,14	99.80	22.30	99.1421	00
20081203	D096	L08	20.0336	8.7	26.0	1,9,11,12,14	99.80	22.30	108.584	00

Table A4: CMM Chamber Volume Calibrations Notes. Made by Transfer of CO_2 from Plenums. Data and calculated results are listed for measurements in the CMM of CO_2 gas transferred from plenums into the small manometer. The CMM measurements of mercury heights and temperature allow calculation of the ratio V/n using the virial equation of state, where V is the volume of the CMM chamber and n the number of moles of CO_2. When this ratio is multiplied by the moles of CO_2 contained in the plenum, as determined by the filling detailed in Tables A1 and A2, the volume of the CMM chamber results. Notes on the columns in the table follow.

Date	Date of the measurement, in YYYYMMDD.
Fill	Designated number of the plenum fill, as listed in Tables A1 and A2.
Plnm	Number of plenum. The original set of plenums with prefix P and the set of larger plenums with prefix L (from 7 to 20 cc in volume), were used to calibrate chambers in the "small" CMM.
Chmb	Nominal volume of the CMM chamber, in cc.
No	Consecutive number of CMM chamber calibration.
HtVac	Mercury column height, in mm, of the vacuum column #2 of the CMM, asmeasured with the cathetometer.
HtSmp	Mercury column height, in mm, of the sample column #4 of the CMM, asmeasured with the cathetometer
MnCor	Correction applied to the mercury column measurements to account fordiffering sizes of the glass tubing on the vacuum and sample columnsand for non-level swing of the cathetometer telescope. Corrections, inmm, were determined experimentally.
Temp	Temperature, in C, for the measurement as read on thermometer No. 6112near the 4 cc chamber, and corrected according to its time-dependenceover the history of measurements.
μ-MolesCO2	Amount of CO_2 in the plenum, in micromoles (from Tables 3 and 4).
V/n	Ratio calculated from CMM measurement (cc/mole).
ChmbVol	Calculated volume of CMM chamber, in cc.
Flg	Flag column.

Table A4: CMM Chamber Volume Calibrations, by Transfer of CO_2 from Plenums. Page 1/6

Date	Fill	Plnm	Chmb	No.	HtVac	HtSmp	MnCor	Temp	μ-MolesCO2	V/N	ChmbVol	Flg
19740621	B001	P07	4	1	827.298	370.618	-0.366	20.50	94.4635	40200.6	3.79749	00
19740621	B001	P07	4	1	826.917	370.566	-0.366	20.36	94.4635	40209.3	3.79831	00
19740621	B002	P01	4	2	631.725	370.605	-0.366	20.24	53.9302	70380.4	3.79563	00
19740621	B002	P01	4	2	631.515	370.580	-0.366	20.03	53.9302	70377.1	3.79545	00
19740626	B003	P01	4	3	631.522	370.838	-0.366	19.72	53.8959	70366.0	3.79244	01
19740626	B003	P01	4	3	631.485	370.820	-0.366	19.69	53.8959	70363.6	3.79231	01
19740627	B004	P07	4	4	826.306	370.820	-0.366	19.93	94.4036	40223.1	3.79721	00
19740627	B004	P07	16	4	418.110	309.656	-0.014	19.80	94.4036	169148.	15.9682	00
19740627	B004	P07	16	4	418.100	309.654	-0.014	19.84	94.4036	169185.	15.9717	00
19740627	B004	P07	4	4	826.096	370.792	-0.366	19.86	94.4036	40229.1	3.79777	00
19740627	B004	P07	16	4	418.070	309.648	-0.014	19.82	94.4036	169210.	15.9741	00
19740628	B004	P07	4	4	826.475	370.830	-0.366	20.09	94.4036	40232.4	3.79808	00
19740628	B004	P07	16	4	418.079	309.650	-0.014	19.88	94.4036	169236.	15.9765	00
19740628	B004	P07	16	4	418.062	309.650	-0.014	19.88	94.4036	169263.	15.9790	00
19740709	B005	P07	4	5	827.928	370.798	-0.366	20.83	94.7677	40208.8	3.81050	02
19740709	B005	P07	4	5	827.923	370.804	-0.366	20.79	94.7677	40204.0	3.81004	02
19740710	B006	P01	4	6	633.268	370.806	-0.366	20.87	54.1038	70178.6	3.79693	00
19740710	B006	P01	4	6	633.304	370.818	-0.366	20.87	54.1038	70172.2	3.79658	00
19740729	B007	P07	4	7	826.286	370.798	-0.366	19.56	94.5036	40168.9	3.79611	00
19740730	B008	P01	4	8	630.979	370.822	-0.366	19.24	53.9530	70386.6	3.79757	00
19740730	B008	P01	4	8	630.953	370.818	-0.366	19.16	53.9530	70372.2	3.79679	00
19740730	B009	P01	4	9	631.683	370.800	-0.366	19.35	54.0820	70218.2	3.79754	00
19740730	B009	P01	4	9	631.513	370.800	-0.366	19.27	54.0820	70243.7	3.79892	01
19740730	B010	P07	4	10	826.460	370.788	-0.366	19.02	94.7294	40073.8	3.79617	00
19740730	B010	P07	4	10	826.322	370.791	-0.366	18.98	94.7294	40080.4	3.79679	00
19740801	B011	P07	4	11	827.544	371.094	-0.366	19.69	94.6889	40102.8	3.79729	00
19740801	B011	P07	4	11	827.421	371.064	-0.366	19.60	94.6889	40097.9	3.79683	00
19740801	B012	P01	4	12	631.828	371.018	-0.366	19.43	54.0588	70258.1	3.79807	00
19740802	B012	P01	4	12	631.954	371.058	-0.366	19.48	54.0588	70247.6	3.79750	00
19740807	B013	P03	4	13	699.303	371.073	-0.366	19.92	67.9395	55883.2	3.79668	00
19740807	B013	P03	4	13	699.182	371.074	-0.366	19.83	67.9395	55885.9	3.79686	00
19740808	B014	P05	4	14	738.966	371.084	-0.366	19.68	76.2449	49796.6	3.79674	00
19740808	B014	P05	4	14	738.667	371.076	-0.366	19.51	76.2449	49805.4	3.79741	00
19740808	B015	P04	4	15	719.972	371.044	-0.366	18.99	72.4948	52380.2	3.79729	00
19740808	B015	P04	4	15	719.888	371.036	-0.366	18.94	72.4948	52382.1	3.79743	00
19740809	B016	P01	4	16	631.340	371.070	-0.366	19.56	53.8977	70437.5	3.79642	00
19740809	B016	P01	4	16	631.257	371.060	-0.366	19.55	53.8977	70454.8	3.79735	00
19851024	B017	P01	4	17	637.122	374.874	-0.340	21.14	53.9677	70296.1	3.79372	00
19851024	B017	P01	4	17	637.252	374.860	-0.340	21.26	53.9677	70287.8	3.79327	00
19851024	B018	P07	4	18	833.848	374.860	-0.340	21.48	94.5344	40136.6	3.79429	00
19851024	B018	P07	4	18	834.170	374.872	-0.340	21.63	94.5344	40131.1	3.79377	00
19851025	B019	P01	4	19	637.272	374.885	-0.340	21.92	53.8207	70456.0	3.79199	00
19851025	B019	P01	4	19	637.292	374.886	-0.340	21.94	53.8207	70456.0	3.79199	00
19851025	B020	P07	4	20	833.337	374.894	-0.340	21.92	94.2770	40248.4	3.79450	00
19851025	B020	P07	4	20	833.336	374.886	-0.340	21.91	94.2770	40246.3	3.79430	00
19851030	B021	P01	4	21	636.956	374.903	-0.340	21.32	53.8882	70394.1	3.79341	00
19851030	B021	P01	4	21	637.071	374.906	-0.340	21.42	53.8882	70389.3	3.79315	00
19851030	B022	P03	4	22	705.414	374.887	-0.340	21.68	67.9291	55841.8	3.79328	00
19851030	B022	P03	4	22	705.606	374.914	-0.340	21.83	67.9291	55844.0	3.79343	00
19851031	B023	P04	4	23	727.812	374.910	-0.340	22.10	72.4491	52368.8	3.79407	02
19851031	B023	P04	4	23	727.800	374.887	-0.340	22.09	72.4491	52365.3	3.79382	02
19851031	B024	P05	4	24	745.868	374.884	-0.340	22.07	76.2065	49802.4	3.79527	02
19851031	B024	P05	4	24	745.880	374.886	-0.340	22.10	76.2065	49806.5	3.79558	02
19851031	B025	P07	4	25	834.332	374.872	-0.340	22.14	94.3952	40190.8	3.79382	00
19851031	B025	P07	4	25	834.346	374.892	-0.340	22.15	94.3952	40192.8	3.79401	00
19860121	B026	P01	4	26	636.946	374.830	-0.340	21.32	53.8998	70377.1	3.79331	00
19860121	B026	P01	4	26	637.048	374.847	-0.340	21.42	53.8998	70379.5	3.79344	00
19860122	B027	P02	4	27	670.337	374.854	-0.340	21.62	60.7171	62473.7	3.79322	00
19860122	B027	P02	4	27	670.418	374.846	-0.340	21.65	60.7171	62461.5	3.79248	00
19860122	B028	P03	4	28	705.354	374.848	-0.340	21.67	67.9438	55843.2	3.79420	00
19860122	B028	P03	4	28	705.400	374.824	-0.340	21.71	67.9438	55839.4	3.79394	00
19860122	B029	P06	4	29	786.092	374.866	-0.340	21.72	84.5872	44855.7	3.79422	00
19860122	B029	P06	4	29	786.106	374.834	-0.340	21.74	84.5872	44853.9	3.79407	00
19860123	B030	P07	4	30	833.883	374.858	-0.340	21.78	94.4157	40176.8	3.79332	00
19860123	B030	P07	4	30	833.700	374.856	-0.340	21.68	94.4157	40178.2	3.79345	00
19860124	B031	P01	4	31	638.445	374.834	-0.340	21.80	54.1025	70097.5	3.79245	00
19860124	B031	P01	4	31	638.440	374.846	-0.340	21.78	54.1025	70096.9	3.79242	00
19860124	B032	P03	4	32	706.632	374.872	-0.340	21.69	68.1993	55635.5	3.79430	00
19860124	B032	P03	4	32	706.596	374.859	-0.340	21.66	68.1993	55633.3	3.79415	00
19860124	B033	P05	4	33	746.440	374.831	-0.340	21.46	76.5090	49609.2	3.79555	02
19860124	B033	P05	4	33	746.436	374.829	-0.340	21.48	76.5090	49613.0	3.79584	02
19860124	B034	P07	4	34	834.976	374.836	-0.340	21.48	94.7707	40035.7	3.79421	00
19860124	B034	P07	4	34	834.988	374.824	-0.340	21.49	94.7707	40035.1	3.79415	00

Table A4: CMM Chamber Volume Calibrations, by Transfer of CO_2 from Plenums. Page 2/6

Date	Fill	Plnm	Chmb	No.	HtVac	HtSmp	MnCor	Temp	μ-MolesCO2	V/N	ChmbVol	Flg
19860127	B035	P04	4	35	727.628	374.836	-0.340	21.07	72.7365	52191.1	3.79620	02
19880219	B036	P01	4	36	637.473	374.830	-0.294	21.13	54.0594	70176.3	3.79369	00
19880219	B036	P01	4	36	637.585	374.814	-0.294	21.21	54.0594	70162.3	3.79293	00
19880222	B037	P07	4	37	834.938	374.822	-0.294	21.66	94.6961	40060.6	3.79358	00
19880222	B037	P07	4	37	835.898	374.780	-0.294	22.22	94.6961	40053.9	3.79295	00
19880223	B038	P01	4	38	636.999	374.824	-0.294	21.23	53.9339	70327.4	3.79303	00
19880223	B038	P01	4	38	637.050	374.814	-0.294	21.28	53.9339	70323.7	3.79283	00
19880223	B038	P01	4	38	637.097	374.791	-0.294	21.31	53.9339	70312.4	3.79222	00
19880224	B039	P02	4	39	669.866	374.814	-0.294	21.05	60.7561	62428.5	3.79291	00
19880224	B039	P02	4	39	669.906	374.820	-0.294	21.12	60.7561	62436.9	3.79342	00
19880224	B040	P03	4	40	704.841	374.828	-0.294	21.23	67.9871	55831.6	3.79583	00
19880224	B040	P03	4	40	705.011	374.772	-0.294	21.30	67.9871	55807.4	3.79418	00
19880224	B041	P06	4	41	785.696	374.813	-0.294	21.37	84.6412	44832.4	3.79467	00
19880224	B041	P06	4	41	785.803	374.777	-0.294	21.43	84.6412	44826.5	3.79417	00
19880225	B042	P07	4	42	833.400	374.835	-0.294	21.39	94.4764	40157.3	3.79392	00
19880225	B042	P07	4	42	833.537	374.826	-0.294	21.49	94.4764	40159.0	3.79408	00
19880225	B043	P07	4	43	833.090	374.822	-0.294	21.35	94.4334	40177.7	3.79412	00
19880225	B043	P07	4	43	833.220	374.800	-0.294	21.40	94.4334	40171.6	3.79354	00
19880225	B044	P06	4	44	785.245	374.796	-0.294	21.47	84.6027	44896.2	3.79834	01
19880225	B044	P06	4	44	785.558	374.788	-0.294	21.48	84.6027	44862.6	3.79550	00
19880226	B045	P03	4	45	704.916	374.816	-0.294	21.33	67.9562	55837.0	3.79447	00
19880226	B045	P03	4	45	704.990	374.822	-0.294	21.37	67.9562	55833.5	3.79423	00
19880226	B046	P02	4	46	670.058	374.824	-0.294	21.47	60.7285	62484.2	3.79457	00
19880226	B046	P02	4	46	670.064	374.800	-0.294	21.50	60.7285	62484.7	3.79460	00
19880226	B047	P01	4	47	637.078	374.795	-0.294	21.58	53.9094	70386.8	3.79451	00
19880226	B047	P01	4	47	637.148	374.796	-0.294	21.60	53.9094	70373.3	3.79378	00
19880302	B048	P01	4	48	635.978	374.843	-0.294	20.64	53.8304	70458.3	3.79280	00
19880302	B048	P01	4	48	636.080	374.842	-0.294	20.74	53.8304	70455.9	3.79267	00
19880302	B049	P02	4	49	669.190	374.832	-0.294	21.01	60.6395	62567.0	3.79403	00
19880302	B049	P02	4	49	669.329	374.838	-0.294	21.08	60.6395	62554.4	3.79327	00
19880303	B050	P04	4	50	726.209	374.848	-0.294	21.31	72.3645	52443.9	3.79508	02
19880303	B050	P04	4	50	726.314	374.834	-0.294	21.38	72.3645	52439.4	3.79475	02
19880303	B051	P05	4	51	744.208	374.832	-0.294	21.35	76.1195	49885.1	3.79723	02
19880303	B051	P05	4	51	744.376	374.879	-0.294	21.41	76.1195	49879.5	3.79680	02
19880303	B052	P07	4	52	832.530	374.848	-0.294	21.38	94.2950	40233.7	3.79384	00
19880303	B052	P07	4	52	832.589	374.851	-0.294	21.43	94.2950	40236.1	3.79406	00
19900209	B053	P01	4	53	638.096	375.108	-0.313	21.66	53.9904	70221.7	3.79130	00
19900209	B053	P01	4	53	638.127	375.090	-0.313	21.72	53.9904	70223.8	3.79141	00
19900209	B054	P07	4	54	834.755	375.054	-0.313	21.76	94.5762	40112.3	3.79367	00
19900209	B054	P07	4	54	835.097	375.088	-0.313	21.83	94.5762	40095.5	3.79208	00
19900209	B055	P09	64	55	855.163	232.413	0.000	21.77	2141.05	29557.6	63.2843	00
19900209	B055	P09	64	55	855.408	232.419	0.000	21.87	2141.05	29556.9	63.2828	00
19900209	B055	P09	250	55	304.780	182.502	0.000	21.95	2141.05	151152.	323.623	00
19900209	B055	P09	250	55	304.689	182.432	0.000	21.99	2141.05	151199.	323.725	00
19900212	B056	P01	4	56	637.248	375.128	-0.313	21.51	53.8478	70417.0	3.79180	01
19900212	B056	P01	4	56	637.097	375.113	-0.313	21.60	53.8478	70476.4	3.79500	00
19900213	B057	P07	4	57	833.224	375.100	-0.313	21.63	94.3264	40232.1	3.79495	00
19900213	B057	P07	4	57	833.423	375.104	-0.313	21.73	94.3264	40229.5	3.79470	00
19900213	B058	P09	64	58	853.540	232.458	0.000	21.83	2135.40	29643.7	63.3011	00
19900213	B058	P09	64	58	853.887	232.442	0.000	21.97	2135.40	29641.4	63.2960	00
19900213	B058	P09	250	58	304.299	182.372	0.000	22.03	2135.40	151630.	323.791	00
19900213	B058	P09	250	58	304.347	182.392	0.000	22.06	2135.40	151612.	323.751	00
19900215	B059	P01	4	59	636.083	375.088	-0.313	20.84	53.7667	70551.1	3.79330	00
19900215	B059	P01	4	59	636.189	375.078	-0.313	20.94	53.7667	70545.2	3.79298	00
19900215	B060	P07	4	60	831.744	375.086	-0.313	21.07	94.1842	40280.1	3.79375	00
19900215	B060	P07	4	60	831.856	375.060	-0.313	21.16	94.1842	40281.1	3.79384	00
19900215	B061	P02	4	61	669.296	375.056	-0.313	21.24	60.5682	62647.1	3.79442	00
19900215	B061	P02	4	61	669.432	375.052	-0.313	21.33	60.5682	62637.5	3.79384	00
19900216	B062	P03	4	62	704.165	375.067	-0.313	21.23	67.7765	55989.8	3.79479	00
19900216	B062	P03	4	62	704.280	375.064	-0.313	21.35	67.7765	55993.7	3.79506	00
19900216	B063	P06	4	63	785.062	375.079	-0.313	21.66	84.3792	44979.7	3.79535	00
19900216	B063	P06	4	63	785.215	375.079	-0.313	21.72	84.3792	44972.6	3.79475	00
19900216	B064	P09	250	64	304.058	182.416	0.000	21.67	2132.18	151790.	323.644	00
19900216	B064	P09	250	64	304.076	182.430	0.000	21.70	2132.18	151802.	323.668	00
19900216	B064	P09	64	64	852.477	232.460	0.000	21.73	2132.18	29684.1	63.2918	00
19901004	B065	P01	4	65	638.148	375.285	-0.313	22.07	53.8751	70360.9	3.79070	00
19901004	B065	P01	4	65	638.156	375.277	-0.313	22.15	53.8751	70376.9	3.79156	00
19901005	B066	P07	4	66	834.889	375.256	-0.313	22.20	94.3746	40183.3	3.79228	00
19901005	B066	P07	4	66	835.051	375.266	-0.313	22.30	94.3746	40184.3	3.79238	00
19901005	B067	P02	4	67	671.334	375.235	-0.313	22.34	60.6906	62501.1	3.79323	00
19901005	B067	P02	4	67	671.458	375.225	-0.313	22.40	60.6906	62486.3	3.79233	00
19901005	B068	P03	4	68	706.425	375.244	-0.313	22.46	67.9134	55884.8	3.79533	00
19901005	B068	P03	4	68	706.500	375.234	-0.313	22.52	67.9134	55882.5	3.79517	00

Table A4: CMM Chamber Volume Calibrations, by Transfer of CO_2 from Plenums. Page 3/6

Date	Fill	Plnm	Chmb	No.	HtVac	HtSmp	MnCor	Temp	μ-MolesCO2	V/N	ChmbVol	Flg
19901005	B069	P06	4	69	787.442	375.232	-0.313	22.52	84.5497	44875.9	3.79424	00
19901005	B069	P06	4	69	787.725	375.262	-0.313	22.61	84.5497	44862.7	3.79313	00
19901006	B070	P07	4	70	833.783	375.241	-0.313	22.38	94.1083	40305.4	3.79307	00
19901006	B070	P07	4	70	833.887	375.218	-0.313	22.44	94.1083	40302.8	3.79283	00
19901006	B071	P01	4	71	637.510	375.261	-0.313	22.47	53.7231	70627.5	3.79433	00
19901006	B071	P01	4	71	637.516	375.218	-0.313	22.50	53.7231	70621.8	3.79402	00
19901009	B072	P03	4	72	705.597	375.184	-0.313	21.85	67.8812	55892.5	3.79405	00
19901009	B072	P03	4	72	705.829	375.204	-0.313	22.00	67.8812	55886.6	3.79365	00
19901009	B073	P01	4	73	637.878	375.204	-0.313	22.17	53.8496	70436.9	3.79300	00
19901009	B073	P01	4	73	637.988	375.215	-0.313	22.28	53.8496	70438.2	3.79307	00
19901009	B074	P07	4	74	834.522	375.220	-0.313	22.32	94.3299	40229.7	3.79486	00
19901009	B074	P07	4	74	834.506	375.194	-0.313	22.33	94.3299	40230.3	3.79492	00
19901010	B075	P02	4	75	670.800	375.171	-0.313	21.99	60.6619	62522.3	3.79272	00
19901010	B075	P02	4	75	671.010	375.186	-0.313	22.27	60.6619	62543.7	3.79402	00
19901010	B076	P06	4	76	787.027	375.208	-0.313	22.48	84.5096	44912.2	3.79551	00
19901010	B076	P06	4	76	787.039	375.188	-0.313	22.54	84.5096	44918.3	3.79603	00
19931013	B077	P01	4	77	637.849	375.226	-0.288	21.78	53.8482	70343.7	3.78788	00
19931013	B077	P01	4	77	637.884	375.196	-0.288	21.82	53.8482	70336.4	3.78749	00
19931013	B078	P07	4	78	834.444	375.213	-0.288	21.88	94.3287	40169.0	3.78909	00
19931013	B078	P07	4	78	834.444	375.204	-0.288	21.91	94.3287	40172.6	3.78943	00
19931014	B079	P09	64	79	851.945	232.552	0.000	21.76	2135.53	29717.6	63.4629	00
19931014	B079	P09	64	79	852.012	232.499	0.000	21.83	2135.53	29719.3	63.4666	00
19931015	B079	P09	250	79	303.885	182.512	0.000	21.61	2135.53	152095.	324.804	00
19931015	B079	P09	250	79	303.858	182.499	0.000	21.64	2135.53	152129.	324.877	00
19940201	B080	P01	4	80	639.217	375.064	-0.288	21.59	54.2372	69887.3	3.79049	00
19940201	B080	P01	4	80	639.224	375.043	-0.288	21.64	54.2372	69892.4	3.79077	00
19940201	B081	P07	4	81	836.846	375.051	-0.288	21.78	95.0104	39930.7	3.79383	00
19940201	B081	P07	4	81	837.086	375.099	-0.288	21.83	95.0104	39921.2	3.79293	00
19940201	B082	P02	4	82	672.645	375.065	-0.288	21.66	61.0995	62030.6	3.79004	00
19940201	B082	P02	4	82	672.684	375.052	-0.288	21.69	61.0995	62026.4	3.78978	00
19940202	B083	P03	4	83	707.851	375.064	-0.288	21.68	68.3703	55452.9	3.79133	00
19940202	B083	P03	4	83	707.987	375.041	-0.288	21.76	68.3703	55442.3	3.79061	00
19940202	B084	P06	4	84	788.806	375.048	-0.288	21.78	85.1187	44584.6	3.79498	01
19940202	B084	P06	4	84	789.300	375.046	-0.288	21.86	85.1187	44543.8	3.79151	00
19940203	B085	P01	4	85	637.954	375.071	-0.288	21.70	53.9223	70253.7	3.78824	00
19940203	B085	P01	4	85	637.987	375.039	-0.288	21.81	53.9223	70263.9	3.78879	00
19940203	B086	P07	4	86	834.727	375.066	-0.288	21.95	94.4587	40141.4	3.79170	00
19940203	B086	P07	4	86	834.981	375.058	-0.288	22.11	94.4587	40141.6	3.79172	00
19940203	B087	P09	64	87	855.740	232.421	0.000	22.25	2138.48	29581.9	63.2604	00
19940203	B087	P09	64	87	855.745	232.410	0.000	22.32	2138.48	29588.7	63.2748	00
19940203	B087	P09	250	87	304.653	182.372	0.000	22.42	2138.48	151403.	323.772	00
19940203	B087	P09	250	87	304.621	182.306	0.000	22.42	2138.48	151361.	323.682	00
19940208	B088	P01	4	88	634.582	375.080	-0.288	22.09	53.1693	71271.4	3.78945	00
19940208	B088	P01	4	88	634.514	375.060	-0.288	22.13	53.1693	71294.7	3.79069	00
19940208	B089	P07	4	89	828.360	375.070	-0.288	21.96	93.1397	40709.2	3.79164	00
19940208	B089	P07	4	89	828.434	375.041	-0.288	22.02	93.1397	40708.6	3.79159	00
19940208	B090	P02	4	90	667.016	375.078	-0.288	22.13	59.8965	63339.9	3.79384	00
19940208	B090	P02	4	90	667.113	375.059	-0.288	22.13	59.8965	63314.7	3.79233	00
19940208	B091	P03	4	91	702.052	375.048	-0.288	22.26	67.0242	56554.5	3.79052	00
19940208	B091	P03	4	91	702.155	375.072	-0.288	22.32	67.0242	56553.0	3.79042	00
19940209	B092	P06	4	92	781.010	375.090	-0.288	21.95	83.4428	45476.4	3.79468	00
19940209	B092	P06	4	92	781.308	375.084	-0.288	22.14	83.4428	45473.3	3.79442	00
19940209	B093	P09	64	93	846.706	232.400	0.000	22.13	2108.62	30004.8	63.2687	00
19940209	B093	P09	64	93	846.798	232.404	0.000	22.20	2108.62	30008.1	63.2757	00
19940209	B093	P09	250	93	302.939	182.374	0.000	22.33	2108.62	153510.	323.695	00
19940209	B093	P09	250	93	302.974	182.372	0.000	22.37	2108.62	153485.	323.642	00
19981210	B094	P01	4	94	640.728	374.999	-0.208	22.35	54.4082	69640.1	3.78899	00
19981210	B094	P01	4	94	640.808	374.976	-0.208	22.41	54.4082	69628.1	3.78834	00
19981211	B095	P07	4	95	838.767	374.952	-0.208	21.99	95.3122	39779.2	3.79144	00
19981211	B095	P07	4	95	839.054	374.964	-0.208	22.14	95.3122	39777.1	3.79124	00
19981214	B096	P01	4	96	638.566	374.982	-0.208	22.01	54.0366	70122.7	3.78919	00
19981214	B096	P01	4	96	638.696	374.982	-0.208	22.12	54.0366	70115.8	3.78882	00
19981214	B097	P02	4	97	671.985	374.982	-0.208	22.33	60.8749	62284.1	3.79154	00
19981214	B097	P02	4	97	672.065	374.978	-0.208	22.39	60.8749	62280.0	3.79129	00
19981215	B098	P03	4	98	707.174	374.953	-0.208	22.32	68.1182	55662.1	3.79160	00
19981215	B098	P03	4	98	707.341	374.980	-0.208	22.46	68.1182	55666.5	3.79190	00
19981215	B099	P06	4	99	788.677	374.961	-0.208	22.75	84.8052	44736.2	3.79386	00
19981215	B099	P06	4	99	788.880	374.978	-0.208	22.77	84.8052	44719.3	3.79243	00
19981216	B100	P07	4	100	835.716	374.979	-0.208	22.29	94.6612	40089.2	3.79489	00
19981216	B100	P07	4	100	835.680	374.952	-0.208	22.40	94.6612	40105.9	3.79647	01
19981216	B100	P07	4	100	836.118	374.969	-0.208	22.53	94.6612	40087.9	3.79477	00
19990106	B101	P02	4	101	672.224	374.991	-0.208	22.52	60.8692	62278.3	3.79083	00
19990106	B101	P02	4	101	672.300	374.990	-0.208	22.59	60.8692	62277.8	3.79080	00

Table A4: CMM Chamber Volume Calibrations, by Transfer of CO_2 from Plenums. Page 4/6

Date	Fill	Plnm	Chmb	No.	HtVac	HtSmp	MnCor	Temp	μ-MolesCO2	V/N	ChmbVol	Flg
19990107	B102	P07	4	102	836.028	375.042	-0.208	22.46	94.6525	40092.0	3.79481	00
19990107	B102	P07	4	102	836.136	374.972	-0.208	22.55	94.6525	40089.5	3.79457	00
19990107	B103	P01	4	103	638.930	374.978	-0.208	22.76	54.0316	70213.2	3.79373	00
19990107	B103	P01	4	103	639.062	374.972	-0.208	22.78	54.0316	70181.5	3.79202	00
19990107	B104	P06	4	104	788.644	374.993	-0.208	22.92	84.7973	44770.5	3.79642	00
19990107	B104	P06	4	104	788.850	375.004	-0.208	22.92	84.7973	44749.4	3.79463	00
19990107	B105	P03	4	105	707.442	374.964	-0.208	22.95	68.1119	55744.7	3.79688	00
19990107	B105	P03	4	105	707.602	375.000	-0.208	22.95	68.1119	55723.9	3.79546	00
19990113	B106	P01	4	106	639.326	375.035	-0.208	22.40	54.1287	70032.5	3.79077	00
19990113	B106	P01	4	106	639.518	375.059	-0.208	22.48	54.1287	70008.0	3.78944	00
19990113	B107	P07	4	107	837.558	374.977	-0.208	22.66	94.8225	39982.1	3.79120	00
19990113	B107	P07	4	107	837.642	374.997	-0.208	22.70	94.8225	39982.3	3.79122	00
19990114	B108	P02	4	108	672.691	374.994	-0.208	22.42	60.9786	62158.7	3.79035	00
19990114	B108	P02	4	108	672.788	374.960	-0.208	22.52	60.9786	62153.4	3.79003	00
19990114	B109	P06	4	109	789.648	374.996	-0.208	22.76	84.9496	44636.5	3.79185	00
19990114	B109	P06	4	109	789.768	374.999	-0.208	22.82	84.9496	44633.4	3.79159	00
19990114	B110	P03	4	110	708.470	375.027	-0.208	22.92	68.2342	55577.0	3.79225	00
19990114	B110	P03	4	110	708.490	375.014	-0.208	22.93	68.2342	55573.5	3.79201	00
19990121	B111	P01	4	111	639.787	375.116	-0.208	22.33	54.1743	69914.1	3.78755	00
19990121	B111	P01	4	111	639.887	375.132	-0.208	22.42	54.1743	69914.5	3.78757	00
19990121	B112	P07	4	112	838.038	375.082	-0.208	22.65	94.9024	39948.1	3.79117	00
19990121	B112	P07	4	112	838.186	375.089	-0.208	22.71	94.9024	39944.5	3.79083	00
19990122	B113	P02	4	113	673.146	375.164	-0.208	22.41	61.0300	62096.8	3.78977	00
19990122	B113	P02	4	113	673.152	375.091	-0.208	22.48	61.0300	62095.9	3.78971	00
19990122	B114	P06	4	114	789.904	375.115	-0.208	22.65	85.0212	44604.1	3.79229	00
19990122	B114	P06	4	114	789.960	375.117	-0.208	22.70	85.0212	44606.2	3.79247	00
19990122	B115	P03	4	115	708.675	375.106	-0.208	22.81	68.2918	55533.9	3.79251	00
19990122	B115	P03	4	115	708.741	375.110	-0.208	22.82	68.2918	55525.6	3.79194	00
20050104	D043	P07	4	116	818.356	371.477	-0.254	23.29	91.3750	41491.1	3.79125	00
20050104	D043	P07	4	116	818.346	371.490	-0.254	23.34	91.3750	41500.6	3.79212	00
20050104	D046	P02	4	117	659.381	371.480	-0.254	23.30	58.7607	64494.3	3.78973	00
20050105	D046	P02	4	117	659.297	371.492	-0.254	23.14	58.7607	64479.0	3.78883	00
20050105	D047	P06	4	118	771.892	371.478	-0.254	23.22	81.8597	46311.8	3.79107	00
20050105	D047	P06	4	118	772.044	371.496	-0.254	23.32	81.8597	46312.9	3.79116	00
20050105	D046	P01	4	119	627.170	371.516	-0.254	23.22	52.1585	72632.5	3.78840	00
20050105	D046	P01	4	119	627.276	371.493	-0.254	23.27	52.1585	72608.7	3.78716	00
20050106	D047	P03	4	120	693.132	371.490	-0.254	23.05	65.7520	57658.5	3.79116	00
20050106	D047	P03	4	120	693.276	371.524	-0.254	23.16	65.7520	57661.4	3.79135	00
20050201	D048	P07	4	121	818.648	371.470	-0.254	23.52	91.3745	41497.5	3.79181	00
20050202	D048	P07	4	121	817.654	371.438	-0.254	22.88	91.3745	41491.8	3.79129	00
20050202	D047	P02	4	122	658.827	371.438	-0.254	22.93	58.7611	64524.0	3.79150	00
20050202	D047	P02	4	122	659.004	371.392	-0.254	23.07	58.7611	64506.1	3.79045	00
20050202	D045	P06	4	123	771.707	371.436	-0.254	23.32	81.8598	46345.0	3.79379	00
20050202	D045	P06	4	123	771.918	371.448	-0.254	23.46	81.8598	46345.1	3.79380	00
20050315	D044	P01	4	124	627.854	371.502	-0.254	24.06	52.1585	72651.6	3.78940	00
20050315	D044	P01	4	124	627.753	371.476	-0.254	24.02	52.1585	72662.6	3.78997	00
20050315	D043	P03	4	125	694.270	371.491	-0.254	24.15	65.7524	57681.1	3.79267	00
20050315	D043	P03	4	125	694.542	371.486	-0.254	24.31	65.7524	57664.4	3.79157	00
20050317	D044	P06	4	126	772.320	371.482	-0.254	23.53	81.8591	46314.0	3.79122	00
20050317	D044	P06	4	126	772.303	371.486	-0.254	23.54	81.8591	46318.1	3.79156	00
20050606	D043	P02	4	127	660.160	371.494	-0.254	24.11	58.7614	64509.0	3.79064	00
20050606	D043	P02	4	127	660.407	371.474	-0.254	24.41	58.7614	64518.2	3.79118	00
20050607	D042	P03	4	128	694.353	371.504	-0.254	24.27	65.7525	57693.2	3.79347	01
20050607	D042	P03	4	128	694.384	371.482	-0.254	24.29	65.7525	57687.8	3.79312	01
20050607	D047	P07	4	129	819.838	371.466	-0.254	24.42	91.3745	41520.0	3.79387	00
20050607	D047	P07	4	129	820.196	371.454	-0.254	24.58	91.3745	41509.4	3.79290	00
20050721	D053	P02	4	130	659.784	371.483	-0.254	24.06	58.7366	64579.3	3.79317	00
20050721	D053	P02	4	130	659.830	371.458	-0.254	24.10	58.7366	64572.5	3.79277	00
20050721	D055	P01	4	131	627.582	371.582	-0.254	24.15	52.1374	72774.8	3.79429	00
20050721	D055	P01	4	131	627.647	371.466	-0.254	24.23	52.1374	72743.9	3.79268	00
20050722	D052	P07	4	132	819.649	371.475	-0.254	24.25	91.3372	41513.1	3.79169	00
20050722	D052	P07	4	132	819.540	371.474	-0.254	24.24	91.3372	41521.6	3.79247	00
20050722	D051	P06	4	133	772.661	371.468	-0.254	24.13	81.8256	46372.3	3.79444	00
20050722	D051	P06	4	133	772.731	371.440	-0.254	24.17	81.8256	46367.5	3.79405	00
20050908	D054	P01	4	134	627.426	371.488	-0.254	23.97	52.1368	72745.7	3.79273	00
20050908	D054	P01	4	134	627.440	371.454	-0.254	23.98	52.1368	72734.6	3.79215	00
20050908	D053	P03	4	135	693.773	371.482	-0.254	23.96	65.7245	57729.3	3.79423	00
20050908	D053	P03	4	135	693.886	371.481	-0.254	24.01	65.7245	57719.1	3.79356	00
20050909	D055	P07	4	136	819.012	371.491	-0.254	24.04	91.3370	41542.6	3.79438	00
20050909	D055	P07	4	136	818.946	371.458	-0.254	24.05	91.3370	41547.2	3.79480	00
20051019	D054	P02	4	137	659.644	371.428	-0.254	23.86	58.7364	64552.1	3.79156	00
20051019	D054	P02	4	137	659.686	371.460	-0.254	23.88	58.7364	64554.5	3.79170	00
20051019	D055	P03	4	138	693.747	371.460	-0.254	23.86	65.7250	57709.4	3.79295	00

Table A4: CMM Chamber Volume Calibrations, by Transfer of CO_2 from Plenums. Page 5/6

Date	Fill	Plnm	Chmb	No.	HtVac	HtSmp	MnCor	Temp	μ-MolesCO2	V/N	ChmbVol	Flg
20051019	D055	P03	4	138	693.858	371.428	-0.254	23.90	65.7250	57691.9	3.79180	00
20051020	D053	P06	4	139	772.802	371.472	-0.254	24.07	81.8254	46346.4	3.79231	00
20051020	D053	P06	4	139	772.788	371.441	-0.254	24.08	81.8254	46346.0	3.79228	00
20060111	D056	P07	4	140	818.568	371.442	-0.254	23.77	91.3439	41539.2	3.79435	01
20060111	D056	P07	4	140	818.912	371.434	-0.254	23.88	91.3439	41522.8	3.79285	00
20060111	D056	P07	4	140	818.984	371.422	-0.254	23.96	91.3439	41526.8	3.79322	00
20060112	D057	P01	4	141	626.874	371.449	-0.254	23.43	52.1415	72751.6	3.79338	00
20060112	D057	P01	4	141	627.006	371.439	-0.254	23.55	52.1415	72742.2	3.79289	00
20060112	D058	P03	4	142	693.493	371.434	-0.254	23.64	65.7302	57704.8	3.79295	00
20060112	D058	P03	4	142	693.564	371.456	-0.254	23.69	65.7302	57706.4	3.79305	00
20060428	D056	P02	4	143	659.732	371.466	-0.254	23.95	58.7415	64561.5	3.79244	00
20060428	D056	P02	4	143	659.800	371.450	-0.254	23.98	58.7415	64549.4	3.79173	00
20060619	D059	P03	4	144	694.620	371.464	-0.254	24.59	65.7297	57703.6	3.79284	00
20060619	D059	P03	4	144	694.660	371.449	-0.254	24.65	65.7297	57706.0	3.79300	00
20060619	D058	P06	4	145	773.554	371.455	-0.254	24.74	81.8326	46368.1	3.79442	00
20060619	D058	P06	4	145	773.706	371.470	-0.254	24.78	81.8326	46358.8	3.79366	00
20060823	D059	P01	4	146	627.298	371.450	-0.254	23.79	52.1411	72724.4	3.79193	00
20060823	D059	P01	4	146	627.374	371.430	-0.254	23.85	52.1411	72712.5	3.79131	00
20060823	D057	P02	4	147	659.866	371.422	-0.254	24.07	58.7419	64549.2	3.79174	00
20060824	D057	P02	4	147	659.828	371.453	-0.254	24.00	58.7419	64548.5	3.79170	00
20060824	D054	P07	4	148	818.700	371.453	-0.254	23.83	91.3360	41536.7	3.79380	00
20060824	D054	P07	4	148	818.851	371.422	-0.254	23.92	91.3360	41533.1	3.79347	00
20061204	D062	P01	4	149	626.170	371.482	-0.254	22.53	52.1406	72728.0	3.79208	00
20061204	D062	P01	4	149	626.265	371.475	-0.254	22.59	52.1406	72714.5	3.79138	00
20061204	D064	P03	4	150	692.742	371.484	-0.254	22.91	65.7288	57698.0	3.79242	00
20061204	D064	P03	4	150	692.848	371.457	-0.254	22.98	65.7288	57688.6	3.79180	00
20061205	D063	P06	4	151	770.552	371.424	-0.254	22.56	81.8313	46351.1	3.79297	00
20061205	D063	P06	4	151	770.664	371.424	-0.254	22.68	81.8313	46358.1	3.79354	00
20070308	D064	P02	4	152	660.092	371.464	-0.254	24.32	58.7406	64565.4	3.79261	00
20070308	D064	P02	4	152	660.120	371.444	-0.254	24.37	58.7406	64566.1	3.79265	00
20070309	D064	P02	4	152	659.934	371.464	-0.254	24.17	58.7406	64566.2	3.79266	00
20070309	D062	P07	4	153	819.080	371.428	-0.254	24.07	91.3431	41534.7	3.79391	00
20070309	D062	P07	4	153	819.113	371.428	-0.254	24.08	91.3431	41533.1	3.79376	00
20080108	D065	P07	4	154	816.158	371.416	-0.254	22.45	91.3418	41565.0	3.79662	00
20080109	D065	P07	4	154	816.006	371.444	-0.254	22.14	91.3418	41535.5	3.79393	00
20080109	D065	P07	4	154	816.018	371.430	-0.254	22.15	91.3418	41534.5	3.79384	00
20080109	D065	P07	16	154	416.028	310.302	0.099	22.23	91.3418	174849.	15.9710	00
20080109	D065	P07	16	154	416.022	310.286	0.099	22.28	91.3418	174863.	15.9723	00
20080109	D065	P07	4	154	816.133	371.442	-0.254	22.33	91.3418	41551.8	3.79542	00
20080109	D065	P07	4	154	816.385	371.420	-0.254	22.43	91.3418	41541.1	3.79444	00
20080110	D065	P07	16	154	415.911	310.290	0.099	22.04	91.3418	174904.	15.9760	00
20080110	D065	P07	16	154	415.932	310.276	0.099	22.04	91.3418	174846.	15.9707	00
20080110	D067	P02	4	155	657.355	371.404	-0.254	22.08	58.7412	64651.4	3.79770	01
20080111	D067	P02	4	155	657.358	371.459	-0.254	21.91	58.7412	64623.6	3.79607	00
20080111	D067	P02	4	155	657.393	371.469	-0.254	21.94	58.7412	64625.0	3.79615	00
20080215	E001	L02	16	156	826.528	310.320	0.099	22.70	446.046	35797.9	15.9675	00
20080219	E001	L02	16	156	827.606	310.298	0.099	23.34	446.046	35803.9	15.9702	00
20080219	E001	L02	64	156	359.650	228.800	0.079	23.36	446.046	141871.	63.2809	00
20080219	E001	L02	64	156	359.610	228.753	0.079	23.31	446.046	141838.	63.2662	00
20080220	E001	L02	16	156	827.373	310.250	0.099	23.22	446.046	35801.3	15.9690	00
20080220	E001	L02	16	156	827.566	310.266	0.099	23.29	446.046	35798.0	15.9675	00
20080220	E001	L02	64	156	359.684	228.772	0.079	23.39	446.046	141819.	63.2577	00
20080220	E001	L02	64	156	359.719	228.779	0.079	23.52	446.046	141854.	63.2734	00
20080313	D087	L02	4	157	666.566	371.368	-0.254	24.29	60.1489	63117.7	3.79646	00
20080313	D087	L02	4	157	666.514	371.386	-0.254	24.24	60.1489	63121.4	3.79668	00
20080313	D091	L06	4	158	803.833	371.372	-0.254	24.25	88.2211	43026.6	3.79585	00
20080314	D091	L06	4	158	803.975	371.363	-0.254	24.28	88.2211	43016.1	3.79493	00
20080415	E002	P09	64	159	834.074	228.744	0.079	23.50	2067.40	30598.8	63.2600	00
20080415	E002	P09	64	159	834.109	228.740	0.079	23.54	2067.40	30601.2	63.2650	00
20080415	E002	P09	250	159	297.252	178.648	0.088	23.52	2067.40	156600.	323.754	00
20080415	E002	P09	250	159	297.267	178.670	0.088	23.55	2067.40	156625.	323.808	00
20080416	E002	P09	250	159	297.214	178.682	0.088	23.38	2067.40	156617.	323.790	00
20080416	E002	P09	250	159	297.194	178.681	0.088	23.39	2067.40	156647.	323.853	00
20080416	E002	P09	64	159	833.644	228.713	0.079	23.33	2067.40	30600.3	63.2631	00
20080416	E002	P09	64	159	833.810	228.724	0.079	23.42	2067.40	30602.3	63.2674	00
20080422	E003	P11	250	160	800.729	178.670	0.088	23.41	10880.2	29762.5	323.823	00
20080422	E003	P11	250	160	800.763	178.642	0.088	23.43	10880.2	29761.7	323.814	00
20080422	E003	P11	1000	160	371.730	174.232	0.143	23.38	10880.2	93947.9	1022.18	00
20080422	E003	P11	1000	160	371.782	174.240	0.143	23.41	10880.2	93937.0	1022.06	00
20080520	D090	L04	4	161	735.534	371.412	-0.254	24.31	74.1536	51142.0	3.79236	00
20080520	D090	L04	4	161	735.395	371.432	-0.254	24.18	74.1536	51140.6	3.79226	00
20080520	D088	L05	4	162	802.652	371.408	-0.254	24.08	88.0082	43122.2	3.79511	00
20080521	D088	L05	4	162	801.055	371.420	-0.254	23.01	88.0082	43118.6	3.79479	00

Table A4: CMM Chamber Volume Calibrations, by Transfer of CO_2 from Plenums. Page 6/6

Date	Fill	Plnm	Chmb	No.	HtVac	HtSmp	MnCor	Temp	μ-MolesCO2	V/N	ChmbVol	Flg
20080521	D089	L07	4	163	855.030	371.413	-0.254	22.86	99.1423	38268.3	3.79401	00
20080521	D089	L07	4	163	854.996	371.406	-0.254	22.80	99.1423	38262.3	3.79341	00
20080722	E004	P12	1000	164	771.793	174.144	0.143	22.29	33124.4	30855.3	1022.07	00
20080723	E004	P12	1000	164	771.378	174.146	0.143	22.08	33124.4	30853.5	1022.01	00
20080723	E004	P12	5000	164	296.227	174.168	0.143	22.14	33124.4	151351.	5013.40	00
20080723	E004	P12	5000	164	296.291	174.164	0.143	22.26	33124.4	151331.	5012.76	00
20080818	D090	L01	4	165	569.644	371.416	-0.254	22.79	40.5067	93592.2	3.79111	00
20080818	D090	L01	4	165	569.655	371.428	-0.254	22.79	40.5067	93592.7	3.79113	00
20080818	D089	L02	4	166	665.230	371.416	-0.254	22.77	60.1417	63072.2	3.79327	00
20080818	D089	L02	4	166	665.216	371.396	-0.254	22.81	60.1417	63079.9	3.79373	00
20080819	D091	L03	4	167	706.318	371.428	-0.254	22.81	68.5852	55322.6	3.79431	00
20080819	D091	L03	4	167	706.302	371.414	-0.254	22.81	68.5852	55323.0	3.79434	00
20081119	D090	L06	4	168	804.748	376.383	-0.254	21.52	88.2079	43015.5	3.79431	00
20081119	D090	L06	4	168	804.808	376.392	-0.254	21.60	88.2079	43022.8	3.79495	00
20081119	D091	L04	4	169	736.936	376.366	-0.254	21.53	74.1647	51134.8	3.79240	00
20081120	D091	L04	4	169	735.890	376.386	-0.254	20.63	74.1647	51120.7	3.79135	00
20081120	D091	L07	4	170	857.092	376.370	-0.254	21.20	99.1571	38269.9	3.79473	00
20081121	D091	L07	4	170	856.903	376.388	-0.254	21.04	99.1571	38264.3	3.79418	00
20090318	D094	L01	4	171	575.704	379.392	-0.254	20.00	40.5084	93565.8	3.79020	00
20090318	D094	L01	4	171	575.632	379.389	-0.254	19.99	40.5084	93595.4	3.79140	00
20090318	D093	L03	4	172	710.975	379.422	-0.254	19.99	68.5780	55316.3	3.79348	00
20090318	D093	L03	4	172	711.190	379.396	-0.254	20.13	68.5780	55304.0	3.79264	00
20090319	D095	L05	4	173	804.722	379.420	-0.254	20.03	87.9993	43093.5	3.79220	00
20090319	D095	L05	4	173	804.854	379.394	-0.254	20.14	87.9993	43094.7	3.79230	00
20090707	D092	L02	4	174	686.214	393.430	-0.254	21.68	60.1510	63047.5	3.79237	00
20090707	D092	L02	4	174	686.123	393.440	-0.254	21.68	60.1510	63069.3	3.79368	00
20090707	D094	L06	4	175	821.730	393.426	-0.254	21.57	88.2115	43029.4	3.79569	00
20090707	D094	L06	4	175	821.842	393.444	-0.254	21.62	88.2115	43027.7	3.79554	00
20090708	D093	L04	4	176	754.874	393.443	-0.254	22.14	74.1569	51124.8	3.79126	00
20090708	D093	L04	4	176	754.859	393.440	-0.254	22.17	74.1569	51132.0	3.79179	00
20091109	D092	L07	4	177	853.272	372.468	-0.272	21.01	99.1577	38238.5	3.79164	00
20091109	D092	L07	4	177	853.408	372.450	-0.272	21.10	99.1577	38238.7	3.79166	00
20091110	D095	L01	4	178	569.394	372.448	-0.272	21.09	40.5079	93639.3	3.79313	00
20091110	D095	L01	4	178	569.467	372.485	-0.272	21.10	40.5079	93625.4	3.79257	00
20091110	D092	L03	4	179	705.380	372.462	-0.272	21.03	68.5856	55299.2	3.79273	00
20091110	D092	L03	4	179	705.390	372.453	-0.272	21.07	68.5856	55304.0	3.79306	00
20091110	D092	L03	4	179	705.390	372.453	-0.272	21.07	68.5856	55304.0	3.79306	00

[-25pt]

Table A5: Fills of Nominally 4-liter CMM Flask ("Plenum P13"). Notes Data and calculated results are listed for measurements in the CMM of CO_2 gas contained in the nominally 4-liter flask named "Plenum P13." Its volume determinations by weighing contained water are listed in Table 3. The measured mercury heights and temperature in the CMM, combined with the volume of Plenum P13, allow calculation of the number of moles of CO_2 contained in the plenum using the virial equation of state. Notes on the columns in the table follow.

Date	Date of the measurement, in YYYYMMDD.
Fill	Designated number of the plenum fill.
HtVac	Mercury column height, in mm, measured with the cathetometer in the vacuum column #8 of the large manometer in the CMM.
HtSmp	Mercury column height, in mm, measured with the cathetometer in the sample column #6 of the large manometer of the CMM.
MnCor	Correction applied to the mercury column measurements to account for possible non-level swing of the cathetometer telescope. Corrections, in mm, were determined experimentally.
Temp	Temperature, in C, for the measurement as read on thermometer #6112 near the 4 cc chamber and corrected according to its time-dependence over the history of measurements.
Vol	Volume of Plenum P13, in cc, from the fit versus time of volume calibrations made in 1974 and 2004.
MolesCO2	Calculated amount of CO_2 in Plenum P13, in moles.

Table A5: Fills of Nominally 4-liter CMM Flask ("Plenum P13").

Date	Fill	HtVac	HtSMp	MnCor	Temp	Vol	MolesCO2
19740618	M001	810.640	175.898	-0.100	20.60	3946.30	0.136670
19740620	M002	795.622	175.996	-0.100	20.62	3946.30	0.133391
19740813	M003	804.851	176.442	-0.100	19.76	3946.30	0.135714
19800512	M004	781.453	180.514	-0.013	21.64	3946.21	0.128894
19800513	M005	776.269	180.550	-0.013	21.90	3946.21	0.127650
20060223	M006	757.209	176.911	0.073	23.35	3945.83	0.123715
20060417	M007	747.032	176.958	0.073	23.41	3945.82	0.121501
20060418	M008	755.129	176.849	0.073	23.49	3945.82	0.123221

Table A6: CMM Large Chamber Volume Calibrations. Made by Transfer of CO_2 from Plenum P13. Data and calculated results are listed for measurements in the CMM of CO_2 gas transferred from Plenum P13 into the nominally 5-liter chamber of the large manometer. The measured mercury heights and temperature in the CMM allow calculation of the ratio V/n using the virial equation of state, where V is the volume of the CMM chamber and n the number of moles of CO_2. When this ratio is multiplied by the number of moles of CO_2 determined by the filling of Plenum P13, as detailed in Table A5, the volume of the CMM large manometer chamber results. Notes on the columns in the table follow.

Date	Date of the measurement, in YYYYMMDD.
No	Number of the plenum fill for the calibration.
HtVac	Mercury column height, in mm, measured with the cathetometer in the vacuum column #8 of the large manometer in the CMM.
HtSmp	Mercury column height, in mm, measured with the cathetometer in the sample column #5 of the large manometer of the CMM.
MnCor	Correction applied to the mercury column measurements to account for possible non-level swing of the cathetometer telescope. Corrections, in mm, were determined experimentally.
Temp	Temperature, in C, for the measurement as read on thermometer #6112 near the 4 cc chamber and corrected according to its time-dependence over the history of measurements.
MolesCO2	Amount of CO_2 in Plenum P13, in moles (from Table A5).
V/n	Ratio calculated from CMM measurement (cc/mole).
ChmbVol	Calculated volume of CMM large chamber, in cc.
Flg	Flag column.

Table A6: CMM Large Chamber Volume Calibrations, by Transfer from Plenum P13.

Date	No	HtVac	HtSMp	MnCor	Temp	MolesCO2	V/N	ChmbVol	Flg
19740619	M001	673.488	173.240	-0.098	20.61	0.136700	36681.7	5014.39	00
19740620	M002	661.175	173.304	-0.098	20.36	0.133400	37587.3	5014.15	00
19740813	M003	668.720	173.688	-0.098	19.63	0.135700	36950.0	5014.12	00
19800512	M004	651.909	177.792	-0.012	21.97	0.128900	38899.6	5014.16	00
19800513	M005	647.575	178.008	-0.012	21.97	0.127600	39297.5	5014.36	01
19800514	M005	646.447	177.654	-0.012	21.53	0.127600	39297.5	5014.36	00
20060223	M006	631.051	174.117	0.111	23.24	0.123700	40539.5	5014.74	00
20060418	M007	623.921	174.114	0.111	23.87	0.121500	41272.2	5014.57	00
20060419	M008	629.802	174.168	0.111	23.55	0.123200	40701.6	5014.44	00
20060420	M008	630.210	174.110	0.111	23.82	0.123200	40701.6	5014.44	00

Table A7 Notes. Mercury column data are listed for all measurements of CO_2 reference gases made on the constant-volume mercury-column manometer from December 1969 to February 2010. All measurements were made by Peter Guenther. Notes on the columns in the table follow.

Date	Date of the measurement, in YYYYMMDD
Cyl	High-pressure gas cylinder number stamped onto the cylinder by the manufacturer, without any prefix letters (e.g. most standard-size Coyne steel cylinders have the prefix of DL-)
Run	Consecutive number of reference gas analysis. In almost all cases, there are two measurements of the CO_2 portion measured in the nominally 4 cc chamber paired with one measurement of the total gas portion measured in the nominally 5000 cc chamber. The total gas data are the same in the two lines of data for a single reference gas analysis. In a few cases there are three or more CO_2 measurements: accordingly there will then be three or more lines of data. In the very few runs with two or more total gas measurements, they are averaged and presented as one measurement.
Gas	Type of gas, other than CO_2, comprising the reference gas, i.e. the carrier gas: nitrogen (N2), natural-air (AIR), and synthetic air, consisting of nitrogen and oxygen (SAIR). The gas type determines the second virial coefficient used to calculate the total gas mole fraction.
Vol CO_2 (cc)	The volume listed is that of the nominally 4 cc chamber as determined from its time-dependence over the history of measurements.
Vol Tot (cc)	The volume listed is that of the nominally 5000 cc chamber as determined from a linear fit of chamber volume determinations over the history of measurements.
Temp CO_2, Tot (C)	Temperature for the measurement as read on thermometer #6112 near the 4 cc chamber and corrected according to its time-dependence over the history of measurements.
Ht Vac, CO_2, Tot and Ht Smp CO_2, Tot (mm)	Mercury column height data, in mm, for CO_2 and total gas measurements with the cathetometer. The sample mercury column (Smp) for CO_2 is column #4 at the 4 cc chamber pointer, and the vacuum column (Vac) is column #2. The sample column for total gas is column #5 at the 5000 cc pointer and the vacuum column is column #8.
MnCor CO_2, Tot (mm)	Correction applied to the mercury column measurements to account for differing sizes of the glass tubing on the vacuum and sample columns and for non-level swing of the cathetometer telescope. Corrections were determined experimentally. After 1985 a constant meniscus correction of -0.340 mm for the 4 cc chamber measurement was often applied because of difficulties in accurate measurement of the correction. However, all calibrations of primary reference gases reported here have meniscus corrections that were measured concurrently.
N_2O (ppm)	Mole fraction of N_2O gas in the total gas, as measured by gas chromatography or assumed (0.00 ppm for N2 and SAIR, 0.31 ppm for natural AIR).
Flg	A "1" in either of the two columns indicates that the measurement has been rejected. The first column refers to the CO_2 measurement in the 4 cc chamber and the second column to the total gas measurement in the 5000 cc chamber.
CO_2 (ppm)	Mole fraction of CO_2 corrected by subtraction of the mole fraction of N_2O, since the manometric measurement of CO_2 gas includes the N_2Ocomponent.
Comment	Notes indicating unusual experimental observations. No comment for a flagged measurement usually means that an outlier measurement has been rejected for statistical reasons.

Table A7: Manometric Reference Gas Measurements: Original Data. Page 1/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19691202	6078	1	N2	3.7970	5014.16	19.95	20.09	618.844	772.173	374.697	177.232	-0.364	-0.042	0.00	0	310.94	
19691202	6078	1	N2	3.7970	5014.16	20.03	20.09	618.899	772.173	374.646	177.232	-0.364	-0.042	0.00	10	310.99	RERUN AFTER TRANSFER OUT/IN
19691202	6078	2	N2	3.7970	5014.16	19.85	19.85	618.124	769.870	374.682	177.252	-0.364	-0.042	0.00	0	311.10	
19691203	6078	2	N2	3.7970	5014.16	20.18	19.85	618.472	769.870	374.684	177.252	-0.364	-0.042	0.00	10	311.17	RERUN AFTER TRANSFER OUT/IN
19691203	2399	3	N2	3.7970	5014.16	20.15	20.23	626.890	766.602	374.694	177.249	-0.364	-0.042	0.00	0	324.20	
19691204	2399	3	N2	3.7970	5014.16	20.52	20.23	626.996	766.602	374.678	177.249	-0.364	-0.042	0.00	10	323.93	RERUN AFTER TRANSFER OUT/IN
19691204	2399	4	N2	3.7970	5014.16	20.24	20.34	631.857	777.489	374.685	177.274	-0.364	-0.042	0.00	1	324.66	
19691205	2399	4	N2	3.7970	5014.16	20.17	20.34	631.688	777.489	374.693	177.274	-0.364	-0.042	0.00	11	324.52	RERUN AFTER TRANSFER OUT/IN
19691209	6078	5	N2	3.7970	5014.16	19.82	19.83	617.370	768.700	374.774	177.370	-0.364	-0.042	0.00	0	310.70	
19691209	6078	5	N2	3.7970	5014.16	20.12	19.83	617.566	768.700	374.779	177.370	-0.364	-0.042	0.00	10	310.61	RERUN AFTER TRANSFER OUT/IN
19691210	6078	6	N2	3.7970	5014.16	19.20	19.62	616.716	767.572	374.621	177.315	-0.364	-0.042	0.00	0	311.08	
19691210	6078	6	N2	3.7970	5014.16	19.93	19.62	617.249	767.572	374.620	177.315	-0.364	-0.042	0.00	10	310.95	RERUN AFTER TRANSFER OUT/IN
19691211	10069	7	N2	3.7970	5014.16	18.69	19.89	652.387	771.326	374.613	177.243	-0.364	-0.042	0.00	0	355.79	
19691211	10069	7	N2	3.7970	5014.16	19.47	19.89	653.019	771.326	374.594	177.243	-0.364	-0.042	0.00	10	355.62	RERUN AFTER TRANSFER OUT/IN
19691211	6078	8	N2	3.7970	5014.16	19.80	19.33	620.472	774.840	374.621	177.182	-0.364	-0.042	0.00	0	311.01	
19691212	6078	8	N2	3.7970	5014.16	19.56	19.33	620.165	774.840	374.629	177.182	-0.364	-0.042	0.00	10	310.88	RERUN AFTER TRANSFER OUT/IN
19700310	6078	9	N2	3.7970	5014.16	19.13	19.24	613.548	764.348	371.014	173.649	-0.364	-0.042	0.00	0	311.07	
19700310	6078	9	N2	3.7970	5014.16	19.07	19.24	613.381	764.348	370.996	173.649	-0.364	-0.042	0.00	10	310.94	RERUN AFTER TRANSFER OUT/IN
19700311	2399	10	N2	3.7970	5014.16	19.13	19.08	622.094	760.504	371.019	173.657	-0.364	-0.042	0.00	0	323.99	
19700312	2399	10	N2	3.7970	5014.16	19.20	19.08	622.165	760.504	370.994	173.657	-0.364	-0.042	0.00	10	324.03	RERUN AFTER TRANSFER OUT/IN
19700312	2399	11	N2	3.7970	5014.16	19.30	19.19	624.113	764.160	371.014	173.552	-0.364	-0.042	0.00	1	324.46	
19700312	2399	11	N2	3.7970	5014.16	19.26	19.19	624.026	764.160	371.001	173.552	-0.364	-0.042	0.00	11	324.41	RERUN AFTER TRANSFER OUT/IN
19700423	2399	12	N2	3.7970	5014.16	20.10	19.98	627.755	773.375	370.962	173.374	-0.364	-0.042	0.00	0	324.04	
19700424	2399	12	N2	3.7970	5014.16	19.82	19.98	627.410	773.375	370.948	173.374	-0.364	-0.042	0.00	10	323.95	RERUN AFTER TRANSFER OUT/IN
19700424	10069	13	N2	3.7970	5014.16	19.97	19.82	649.408	766.329	370.963	173.512	-0.364	-0.042	0.00	0	355.67	
19700424	10069	13	N2	3.7970	5014.16	19.80	19.82	649.137	766.329	370.943	173.512	-0.364	-0.042	0.00	10	355.57	RERUN AFTER TRANSFER OUT/IN
19700428	10069	14	N2	3.7970	5014.16	19.50	19.48	651.634	771.880	370.944	173.519	-0.364	-0.042	0.00	0	355.40	
19700428	10069	14	N2	3.7970	5014.16	19.65	19.48	651.895	771.880	370.964	173.519	-0.364	-0.042	0.00	10	355.51	RERUN AFTER TRANSFER OUT/IN
19700429	2399	15	N2	3.7970	5014.16	19.34	19.54	622.990	762.994	370.970	173.472	-0.364	-0.042	0.00	0	324.03	
19700429	2399	15	N2	3.7970	5014.16	19.62	19.54	623.235	762.994	370.973	173.472	-0.364	-0.042	0.00	10	324.01	RERUN AFTER TRANSFER OUT/IN
19700511	7366	16	N2	3.7970	5014.16	19.92	19.74	585.092	759.159	370.982	173.600	-0.364	-0.042	0.00	0	276.62	
19700512	7366	16	N2	3.7970	5014.16	19.61	19.74	584.772	759.159	371.005	173.600	-0.364	-0.042	0.00	10	276.49	RERUN AFTER TRANSFER OUT/IN
19700512	7366	17	N2	3.7970	5014.16	19.59	19.60	587.199	765.191	370.962	173.633	-0.364	-0.042	0.00	0	276.73	
19700512	7366	17	N2	3.7970	5014.16	19.85	19.60	587.418	765.191	370.971	173.633	-0.364	-0.042	0.00	10	276.74	RERUN AFTER TRANSFER OUT/IN
19700513	7366	18	N2	3.7970	5014.16	19.68	19.88	588.257	768.269	370.974	173.495	-0.364	-0.042	0.00	0	276.76	
19700513	7366	18	N2	3.7970	5014.16	19.69	19.88	588.190	768.269	370.949	173.495	-0.364	-0.042	0.00	10	276.70	RERUN AFTER TRANSFER OUT/IN
19700513	2399	19	N2	3.7970	5014.16	20.03	19.60	624.333	764.334	370.965	173.561	-0.364	-0.042	0.00	0	324.33	
19700514	2399	19	N2	3.7970	5014.16	19.62	19.60	623.965	764.334	370.947	173.561	-0.364	-0.042	0.00	10	324.36	RERUN AFTER TRANSFER OUT/IN
19700514	10069	20	N2	3.7970	5014.16	19.67	19.61	646.598	760.347	370.962	173.545	-0.364	-0.042	0.00	0	355.80	
19700514	10069	20	N2	3.7970	5014.16	19.99	19.61	646.910	760.347	370.969	173.545	-0.364	-0.042	0.00	10	355.78	RERUN AFTER TRANSFER OUT/IN
19700515	6078	21	N2	3.7970	5014.16	19.67	20.03	612.586	762.000	370.998	173.492	-0.364	-0.042	0.00	0	311.28	
19700515	6078	21	N2	3.7970	5014.16	19.75	20.03	612.607	762.000	370.976	173.492	-0.364	-0.042	0.00	10	311.25	RERUN AFTER TRANSFER OUT/IN
19700515	2399	22	N2	3.7970	5014.16	20.11	19.79	623.445	762.927	370.956	173.588	-0.364	-0.042	0.00	0	324.12	
19700515	2399	22	N2	3.7970	5014.16	20.38	19.79	623.625	762.927	370.949	173.588	-0.364	-0.042	0.00	10	324.04	RERUN AFTER TRANSFER OUT/IN
19721020	6078	23	N2	3.7970	5014.19	19.37	19.10	619.690	779.329	370.652	173.349	-0.364	-0.042	0.00	0	310.96	
19721020	6078	23	N2	3.7970	5014.19	19.45	19.10	619.609	779.329	370.648	173.349	-0.364	-0.042	0.00	0	310.77	
19721031	2399	24	N2	3.7970	5014.19	19.31	19.66	641.364	805.611	370.633	173.230	-0.364	-0.042	0.00	0	324.73	
19721101	2399	24	N2	3.7970	5014.19	19.41	19.66	641.700	805.611	370.636	173.230	-0.364	-0.042	0.00	0	325.02	
19721102	6078	25	N2	3.7970	5014.19	19.27	19.34	623.334	789.278	370.639	173.298	-0.364	-0.042	0.00	0	310.79	
19721103	6078	25	N2	3.7970	5014.19	19.72	19.34	624.043	789.278	370.672	173.298	-0.364	-0.042	0.00	0	311.12	
19721106	10069	26	N2	3.7970	5014.19	19.88	19.08	667.633	803.699	370.648	173.270	-0.364	-0.042	0.00	0	355.95	
19721106	10069	26	N2	3.7970	5014.19	19.93	19.08	667.629	803.699	370.638	173.270	-0.364	-0.042	0.00	0	355.90	
19721108	2399	27	N2	3.7970	5014.19	19.62	19.62	637.156	795.361	370.658	173.259	-0.364	-0.042	0.00	0	324.52	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 2/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19721108	2399	27	N2	3.7970	5014.19	19.78	19.62	637.490	795.361	370.620	173.259	-0.364	-0.042	0.00	0	324.78	
19721109	10069	28	N2	3.7970	5014.19	19.65	19.67	667.890	805.530	370.647	173.312	-0.364	-0.042	0.00	0	356.31	
19721109	10069	28	N2	3.7970	5014.19	19.70	19.67	667.847	805.530	370.632	173.312	-0.364	-0.042	0.00	0	356.21	
19721113	2399	29	N2	3.7970	5014.19	19.99	19.00	639.276	797.927	370.654	173.277	-0.364	-0.042	0.00	0	324.61	
19721113	2399	29	N2	3.7970	5014.19	20.09	19.00	639.323	797.927	370.646	173.277	-0.364	-0.042	0.00	0	324.56	
19740117	6078	30	N2	3.7970	5014.21	18.04	17.97	630.310	806.112	370.613	173.226	-0.364	-0.042	0.00	0	310.74	
19740118	6078	30	N2	3.7970	5014.21	17.70	17.97	630.018	806.112	370.616	173.226	-0.364	-0.042	0.00	0	310.77	
19740118	6078	31	N2	3.7970	5014.21	19.89	18.09	633.028	808.666	370.615	173.278	-0.364	-0.042	0.00	0	310.81	
19740121	6078	31	N2	3.7970	5014.21	20.55	18.09	633.696	808.666	370.604	173.278	-0.364	-0.042	0.00	0	310.87	
19740121	35435	32	AIR	3.7970	5014.21	20.27	20.40	648.730	803.574	370.629	173.248	-0.364	-0.042	0.29	0	334.09	
19740122	35435	32	AIR	3.7970	5014.21	20.45	20.40	648.808	803.574	370.594	173.248	-0.364	-0.042	0.29	0	334.01	
19740123	35435	33	AIR	3.7970	5014.21	20.44	20.58	648.762	803.725	370.582	173.275	-0.364	-0.042	0.29	0	334.14	
19740123	35435	33	AIR	3.7970	5014.21	20.48	20.58	648.838	803.725	370.590	173.275	-0.364	-0.042	0.29	0	334.17	
19740124	2399	34	N2	3.7970	5014.21	20.62	20.50	642.001	807.787	370.607	173.234	-0.364	-0.042	0.00	0	323.86	
19740124	2399	34	N2	3.7970	5014.21	20.48	20.50	641.622	807.787	370.544	173.234	-0.364	-0.042	0.00	0	323.65	HG JUMPING TOWARDS POINTER
19740125	2399	34	N2	3.7970	5014.21	20.62	20.50	641.968	807.787	370.584	173.234	-0.364	-0.042	0.00	0	323.85	HG JUMPING TOWARDS POINTER
19740128	2399	35	N2	3.7970	5014.21	20.43	20.59	641.952	807.650	370.641	173.232	-0.364	-0.042	0.00	0	324.16	
19740128	2399	35	N2	3.7970	5014.21	20.58	20.59	642.088	807.650	370.603	173.232	-0.364	-0.042	0.00	0	324.19	
19740129	2399	36	N2	3.7970	5014.21	20.31	20.50	639.336	801.884	370.654	173.293	-0.364	-0.042	0.00	0	324.02	
19740130	2399	36	N2	3.7970	5014.21	20.47	20.50	639.482	801.884	370.636	173.293	-0.364	-0.042	0.00	0	324.03	HG JUMPING TOWARDS POINTER
19740130	10069	37	N2	3.7970	5014.21	20.86	20.72	668.694	808.097	370.628	173.326	-0.364	-0.042	0.00	0	355.65	HG JUMPING TOWARDS POINTER
19740131	10069	37	N2	3.7970	5014.21	20.66	20.72	668.442	808.097	370.654	173.326	-0.364	-0.042	0.00	0	355.57	
19740201	10069	38	N2	3.7970	5014.21	20.04	20.86	663.690	799.587	370.674	173.198	-0.364	-0.042	0.00	0	355.51	
19740201	10069	38	N2	3.7970	5014.21	19.95	20.86	663.540	799.587	370.634	173.198	-0.364	-0.042	0.00	0	355.50	
19740201	2424	39	N2	3.7970	5014.21	20.14	20.00	694.926	799.548	370.648	173.217	-0.364	-0.042	0.00	0	392.26	
19740204	2424	39	N2	3.7970	5014.21	20.50	20.00	695.554	799.548	370.672	173.217	-0.364	-0.042	0.00	0	392.48	
19740205	2424	39	N2	3.7970	5014.21	20.22	20.00	695.071	799.548	370.660	173.217	-0.364	-0.042	0.00	0	392.30	
19740205	2424	40	N2	3.7970	5014.21	20.39	20.23	695.576	800.724	370.660	173.258	-0.364	-0.042	0.00	0	392.29	VACUUM COLUMN FALLING DURING MEASUREMENT
19740206	2424	40	N2	3.7970	5014.21	20.75	20.23	695.941	800.724	370.684	173.258	-0.364	-0.042	0.00	0	392.19	
19740206	7366	41	N2	3.7970	5014.21	20.07	20.73	606.055	818.852	370.629	173.252	-0.364	-0.042	0.00	0	276.78	HG JUMPING TOWARDS POINTER
19740207	7366	41	N2	3.7970	5014.21	20.42	20.73	606.245	818.852	370.658	173.252	-0.364	-0.042	0.00	0	276.62	
19740207	7366	41	N2	3.7970	5014.21	20.38	20.73	606.380	818.852	370.622	173.252	-0.364	-0.042	0.00	0	276.86	
19740208	7366	42	N2	3.7970	5014.21	20.05	20.46	604.208	813.325	370.661	173.333	-0.364	-0.042	0.00	0	276.72	
19740208	7366	42	N2	3.7970	5014.21	19.86	20.46	604.116	813.325	370.648	173.333	-0.364	-0.042	0.00	0	276.82	
19740208	3753	43	N2	3.7970	5014.21	20.03	19.97	578.580	812.929	370.658	173.306	-0.364	-0.042	0.00	0	246.00	
19740211	3753	43	N2	3.7970	5014.21	20.99	19.97	579.294	812.929	370.636	173.306	-0.364	-0.042	0.00	0	246.02	
19740212	3753	44	N2	3.7970	5014.21	21.00	20.91	582.288	824.325	370.660	173.280	-0.364	-0.042	0.00	0	245.97	
19740213	3753	44	N2	3.7970	5014.21	20.84	20.91	582.150	824.325	370.656	173.280	-0.364	-0.042	0.00	0	245.96	
19740213	35452	45	SAIR	3.7970	5014.21	20.59	20.97	637.822	799.231	370.630	173.331	-0.364	-0.042	0.00	0	323.80	VACUUM COLUMN FALLING DURING MEASUREMENT
19740213	35452	45	SAIR	3.7970	5014.21	20.54	20.97	637.689	799.231	370.612	173.331	-0.364	-0.042	0.00	0	323.72	VACUUM COLUMN FALLING DURING MEASUREMENT
19740214	35452	46	SAIR	3.7970	5014.21	20.22	20.56	639.234	802.350	370.666	173.350	-0.364	-0.042	0.00	0	323.82	
19740214	35452	46	SAIR	3.7970	5014.21	20.19	20.56	639.229	802.350	370.645	173.350	-0.364	-0.042	0.00	0	323.88	
19740214	35452	46	SAIR	3.7970	5014.21	20.12	20.56	639.196	802.350	370.652	173.350	-0.364	-0.042	0.00	0	323.91	HG CONTACTED POINTER PREMATURELY
19740220	6078	47	N2	3.7970	5014.21	20.11	20.16	627.881	800.465	370.593	173.242	-0.364	-0.042	0.00	0	310.76	
19740221	6078	47	N2	3.7970	5014.21	19.91	20.16	627.693	800.465	370.595	173.242	-0.364	-0.042	0.00	0	310.75	
19740225	35434	48	SAIR	3.7970	5014.21	20.89	20.75	640.876	805.011	370.573	173.240	-0.364	-0.042	0.00	0	323.93	HG CONTACTED POINTER PREMATURELY
19740225	35434	48	SAIR	3.7970	5014.21	20.91	20.75	640.912	805.011	370.570	173.240	-0.364	-0.042	0.00	0	323.95	
19740226	35434	48	SAIR	3.7970	5014.21	20.19	20.75	640.212	805.011	370.622	173.240	-0.364	-0.042	0.00	0	323.89	
19740226	35434	49	SAIR	3.7970	5014.21	20.91	20.28	639.810	801.586	370.593	173.274	-0.364	-0.042	0.00	0	323.83	
19740227	35434	49	SAIR	3.7970	5014.21	20.79	20.28	639.709	801.586	370.624	173.274	-0.364	-0.042	0.00	0	323.81	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 3/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19740227	35389	50	SAIR	3.7970	5014.21	20.57	20.78	649.209	803.450	370.607	173.274	-0.364	-0.042	0.00	0	335.17	
19740227	35389	50	SAIR	3.7970	5014.21	20.69	20.78	649.449	803.450	370.584	173.274	-0.364	-0.042	0.00	0	335.34	
19740228	35389	51	SAIR	3.7970	5014.21	20.07	20.64	648.837	803.218	370.622	173.300	-0.364	-0.042	0.00	0	335.28	
19740228	35389	51	SAIR	3.7970	5014.21	20.12	20.64	649.021	803.218	370.595	173.300	-0.364	-0.042	0.00	0	335.47	
19740228	35441	52	SAIR	3.7970	5014.21	20.84	20.06	646.485	801.108	370.577	173.278	-0.364	-0.042	0.00	0	331.95	
19740301	35441	52	SAIR	3.7970	5014.21	19.56	20.06	645.232	801.108	370.616	173.278	-0.364	-0.042	0.00	0	331.92	
19740301	35441	53	SAIR	3.7970	5014.21	20.08	19.66	647.291	803.402	370.603	173.218	-0.364	-0.042	0.00	0	332.08	HG CONTACTED POINTER PREMATURELY
19740301	35441	53	SAIR	3.7970	5014.21	20.12	19.66	647.306	803.402	370.610	173.218	-0.364	-0.042	0.00	0	332.04	
19740304	35442	54	SAIR	3.7970	5014.21	20.81	20.52	647.417	813.978	370.592	173.276	-0.364	-0.042	0.00	0	326.92	
19740305	35442	54	SAIR	3.7970	5014.21	20.57	20.52	647.324	813.978	370.620	173.276	-0.364	-0.042	0.00	0	327.06	
19740305	35442	55	SAIR	3.7970	5014.21	20.93	20.62	641.505	800.229	370.601	173.332	-0.364	-0.042	0.00	0	326.93	HG CONTACTED POINTER PREMATURELY
19740307	35442	55	SAIR	3.7970	5014.21	20.03	20.62	640.722	800.229	370.625	173.332	-0.364	-0.042	0.00	0	327.01	
19740307	35435	56	AIR	3.7970	5014.21	20.49	20.92	648.074	803.052	370.620	173.280	-0.364	-0.042	0.29	0	333.97	HG CONTACTED POINTER PREMATURELY
19740307	35435	56	AIR	3.7970	5014.21	20.41	20.92	648.027	803.052	370.587	173.280	-0.364	-0.042	0.29	0	334.05	
19740308	2399	57	N2	3.7970	5014.21	20.68	20.55	636.706	795.051	370.580	173.212	-0.364	-0.042	0.00	0	324.04	
19740308	2399	57	N2	3.7970	5014.21	20.76	20.55	636.866	795.051	370.586	173.212	-0.364	-0.042	0.00	0	324.13	
19740409	35405	58	AIR	3.7970	5014.21	20.67	20.28	648.984	797.619	370.643	173.284	-0.364	-0.042	0.29	0	336.96	
19740410	35405	58	AIR	3.7970	5014.21	20.78	20.28	649.046	797.619	370.650	173.284	-0.364	-0.042	0.29	0	336.90	
19740410	44726	59	SAIR	3.7970	5014.21	20.71	20.77	627.215	801.326	370.644	173.243	-0.364	-0.042	0.00	0	309.44	
19740410	44726	59	SAIR	3.7970	5014.21	20.72	20.77	627.325	801.326	370.612	173.243	-0.364	-0.042	0.00	0	309.61	
19740411	35405	60	AIR	3.7970	5014.21	20.94	20.71	653.406	807.931	370.648	173.256	-0.364	-0.042	0.29	0	336.94	
19740411	35405	60	AIR	3.7970	5014.21	20.95	20.71	653.436	807.931	370.607	173.256	-0.364	-0.042	0.29	0	337.01	
19740412	44695	61	SAIR	3.7970	5014.21	20.62	20.95	662.720	802.820	370.636	173.263	-0.364	-0.042	0.00	0	351.94	
19740412	44695	61	SAIR	3.7970	5014.21	20.87	20.95	663.005	802.820	370.631	173.263	-0.364	-0.042	0.00	0	351.97	
19740412	44726	62	SAIR	3.7970	5014.21	20.97	20.87	627.333	801.111	370.614	173.240	-0.364	-0.042	0.00	0	309.55	
19740412	44726	62	SAIR	3.7970	5014.21	20.96	20.87	627.322	801.111	370.618	173.240	-0.364	-0.042	0.00	0	309.54	
19740415	44695	63	SAIR	3.7970	5014.21	20.90	20.88	663.100	803.283	370.624	173.256	-0.364	-0.042	0.00	0	351.71	
19740415	44695	63	SAIR	3.7970	5014.21	20.88	20.88	663.245	803.283	370.632	173.256	-0.364	-0.042	0.00	0	351.90	
19740507	35378	64	AIR	3.7970	5014.21	20.68	20.57	665.224	800.343	370.644	173.254	-0.364	-0.042	0.29	0	355.50	HG CONTACTED POINTER PREMATURELY
19740507	35378	64	AIR	3.7970	5014.21	20.57	20.57	665.161	800.343	370.608	173.254	-0.364	-0.042	0.29	0	355.60	
19740508	35378	65	AIR	3.7970	5014.21	20.87	20.64	665.419	800.246	370.642	173.278	-0.364	-0.042	0.29	0	355.65	
19740508	35378	65	AIR	3.7970	5014.21	20.88	20.64	665.409	800.246	370.616	173.278	-0.364	-0.042	0.29	0	355.66	
19740510	35401	66	AIR	3.7970	5014.21	20.25	20.40	665.067	805.116	370.653	173.232	-0.364	-0.042	0.30	0	352.92	
19740510	35401	66	AIR	3.7970	5014.21	20.15	20.40	664.922	805.116	370.630	173.232	-0.364	-0.042	0.30	0	352.90	
19740510	34770	67	AIR	3.7970	5014.21	20.00	20.19	649.649	797.885	370.630	173.261	-0.364	-0.042	0.29	0	338.34	
19740510	34770	67	AIR	3.7970	5014.21	19.67	20.19	649.455	797.885	370.601	173.261	-0.364	-0.042	0.29	0	338.54	
19740515	34770	68	AIR	3.7970	5014.21	20.51	20.62	650.481	799.107	370.632	173.238	-0.364	-0.042	0.29	0	338.57	
19740515	34770	68	AIR	3.7970	5014.21	20.57	20.62	650.509	799.107	370.600	173.238	-0.364	-0.042	0.29	0	338.57	HG CONTACTED POINTER PREMATURELY
19740515	35401	69	AIR	3.7970	5014.21	20.72	20.53	662.242	798.520	370.602	173.284	-0.364	-0.042	0.30	0	352.87	
19740515	35401	69	AIR	3.7970	5014.21	20.71	20.53	662.328	798.520	370.570	173.284	-0.364	-0.042	0.30	0	353.02	
19740522	2408	70	N2	3.7970	5014.21	20.28	20.20	533.715	799.513	370.644	173.319	-0.364	-0.042	0.00	0	196.90	
19740522	2408	70	N2	3.7970	5014.21	20.35	20.20	533.662	799.513	370.620	173.319	-0.364	-0.042	0.00	0	196.81	
19740522	2408	71	N2	3.7970	5014.21	20.17	20.34	536.086	809.296	370.620	173.247	-0.364	-0.042	0.00	0	196.88	
19740522	2408	71	N2	3.7970	5014.21	20.09	20.34	536.005	809.296	370.602	173.247	-0.364	-0.042	0.00	0	196.86	
19740523	35316	72	N2	3.7970	5014.21	19.84	20.14	758.428	795.825	370.624	173.264	-0.364	-0.042	0.00	0	472.99	TEMPERATURE INSTABILITY
19740523	35316	72	N2	3.7970	5014.21	19.55	20.14	757.934	795.825	370.581	173.264	-0.364	-0.042	0.00	0	472.93	TEMPERATURE INSTABILITY
19740523	35316	73	N2	3.7970	5014.21	19.23	19.73	758.398	796.412	370.618	173.266	-0.364	-0.042	0.00	0	472.86	TEMPERATURE INSTABILITY
19740523	35316	73	N2	3.7970	5014.21	19.38	19.73	758.636	796.412	370.592	173.266	-0.364	-0.042	0.00	0	472.93	
19740524	35299	74	N2	3.7970	5014.21	19.69	19.35	714.074	799.722	370.621	173.256	-0.364	-0.042	0.00	0	415.15	TEMPERATURE INSTABILITY
19740524	35299	74	N2	3.7970	5014.21	19.78	19.35	714.054	799.722	370.582	173.256	-0.364	-0.042	0.00	0	415.03	
19740524	35299	75	N2	3.7970	5014.21	19.86	19.72	714.184	800.763	370.606	173.193	-0.364	-0.042	0.00	0	414.87	
19740524	35299	75	N2	3.7970	5014.21	19.82	19.72	714.235	800.763	370.584	173.193	-0.364	-0.042	0.00	0	415.01	TEMPERATURE INSTABILITY
19741014	39239	76	N2	3.7970	5014.22	19.98	20.15	652.583	815.255	371.044	173.596	-0.364	-0.042	0.00	0	332.64	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 4/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19741014	39239	76	N2	3.7970	5014.22	19.88	20.15	652.609	815.255	371.039	173.596	-0.364	-0.042	0.00	0	332.79	
19741015	39239	76	N2	3.7970	5014.22	19.81	20.15	652.628	815.255	371.068	173.596	-0.364	-0.042	0.00	0	332.86	
19741015	1540	77	N2	3.7970	5014.22	19.81	19.81	685.812	800.690	371.067	173.708	-0.364	-0.042	0.00	0	380.48	
19741015	1540	77	N2	3.7970	5014.22	19.74	19.81	685.739	800.690	371.066	173.708	-0.364	-0.042	0.00	0	380.49	
19741016	39239	78	N2	3.7970	5014.22	19.68	19.92	646.394	800.907	371.068	173.639	-0.364	-0.042	0.00	0	332.82	
19741016	39239	78	N2	3.7970	5014.22	19.68	19.92	646.288	800.907	371.020	173.639	-0.364	-0.042	0.00	0	332.75	
19741017	1540	79	N2	3.7970	5014.22	19.39	19.69	685.224	799.969	371.029	173.625	-0.364	-0.042	0.00	0	380.62	
19741017	1540	79	N2	3.7970	5014.22	19.58	19.69	685.436	799.969	371.032	173.625	-0.364	-0.042	0.00	0	380.61	
19790918	6078	80	N2	3.7970	5014.27	25.10	24.68	631.082	800.626	375.030	177.772	-0.364	-0.042	0.00	0	310.89	
19790918	6078	80	N2	3.7970	5014.27	25.34	24.68	631.308	800.626	375.029	177.772	-0.364	-0.042	0.00	0	310.90	
19790919	6078	81	N2	3.7970	5014.27	25.48	23.57	628.809	791.396	375.025	177.666	-0.364	-0.042	0.00	0	311.06	HG CONTACTED POINTER PREMATURELY
19790919	6078	81	N2	3.7970	5014.27	25.66	23.57	628.880	791.396	375.015	177.666	-0.364	-0.042	0.00	0	310.96	
19790925	2399	82	N2	3.7970	5014.27	21.56	22.72	640.555	800.785	375.046	177.686	-0.364	-0.042	0.00	0	324.11	
19790925	2399	82	N2	3.7970	5014.27	21.75	22.72	640.690	800.785	375.019	177.686	-0.364	-0.042	0.00	0	324.09	CATHETOMETER MANUAL CONTROL SLIPPING
19790925	2399	83	N2	3.7970	5014.27	22.67	21.65	638.898	791.927	375.018	177.644	-0.364	-0.042	0.00	0	324.20	
19790925	2399	83	N2	3.7970	5014.27	22.88	21.65	639.061	791.927	375.020	177.644	-0.364	-0.042	0.00	0	324.16	
19791003	10069	84	N2	3.7970	5014.27	21.57	21.06	665.985	795.945	375.074	177.706	-0.364	-0.042	0.00	0	355.89	
19791003	10069	84	N2	3.7970	5014.27	21.71	21.06	666.104	795.945	375.060	177.706	-0.364	-0.042	0.00	0	355.87	
19791005	10069	85	N2	3.7970	5014.27	21.36	20.90	667.001	798.440	375.058	177.753	-0.364	-0.042	0.00	0	355.81	
19791005	10069	85	N2	3.7970	5014.27	21.53	20.90	667.066	798.440	375.040	177.753	-0.364	-0.042	0.00	0	355.69	
19791009	7366	86	N2	3.7970	5014.27	21.50	21.46	602.787	800.818	375.033	177.788	-0.364	-0.042	0.00	0	276.73	
19791009	7366	86	N2	3.7970	5014.27	21.59	21.46	602.802	800.818	375.042	177.788	-0.364	-0.042	0.00	0	276.65	
19791019	7366	87	N2	3.7970	5014.27	21.55	21.43	602.506	799.952	375.061	177.744	-0.364	-0.042	0.00	0	276.64	
19791019	7366	87	N2	3.7970	5014.27	21.58	21.43	602.506	799.952	375.048	177.744	-0.364	-0.042	0.00	0	276.63	
19800515	34770	88	AIR	3.7970	5014.28	21.84	21.57	651.653	794.843	375.068	177.620	-0.364	-0.042	0.29	11	338.83	INSTRUMENTAL PROBLEM
19800515	34770	88	AIR	3.7970	5014.28	21.80	21.57	651.574	794.843	375.022	177.620	-0.364	-0.042	0.29	11	338.84	INSTRUMENTAL PROBLEM
19800516	34770	89	AIR	3.7970	5014.28	21.75	21.82	651.238	794.023	375.044	177.672	-0.364	-0.042	0.29	11	339.24	INSTRUMENTAL PROBLEM
19800516	34770	89	AIR	3.7970	5014.28	21.78	21.82	651.239	794.023	375.036	177.672	-0.364	-0.042	0.29	11	339.22	INSTRUMENTAL PROBLEM
19800516	35405	90	AIR	3.7970	5014.28	21.81	21.77	650.569	796.399	375.062	177.804	-0.364	-0.042	0.29	0	337.03	
19800516	35405	90	AIR	3.7970	5014.28	21.90	21.77	650.650	796.399	375.044	177.804	-0.364	-0.042	0.29	0	337.04	
19800523	35405	91	AIR	3.7970	5014.28	21.68	21.75	649.951	795.248	375.068	177.698	-0.364	-0.042	0.29	0	336.97	
19800523	35405	91	AIR	3.7970	5014.28	21.73	21.75	649.906	795.248	375.032	177.698	-0.364	-0.042	0.29	0	336.90	
19800529	34770	92	AIR	3.7970	5014.28	22.15	22.15	652.978	799.250	375.058	177.770	-0.364	-0.042	0.29	0	338.46	
19800529	34770	92	AIR	3.7970	5014.28	22.23	22.15	653.030	799.250	375.034	177.770	-0.364	-0.042	0.29	0	338.46	
19800530	35401	93	AIR	3.7970	5014.28	21.67	22.20	663.036	796.914	375.066	177.758	-0.364	-0.042	0.30	0	352.73	HG CONTACTED POINTER PREMATURELY
19800530	35401	93	AIR	3.7970	5014.28	21.84	22.20	663.129	796.914	375.032	177.758	-0.364	-0.042	0.30	0	352.67	
19800530	35401	94	AIR	3.7970	5014.28	21.81	21.76	663.022	795.554	375.059	177.768	-0.364	-0.042	0.30	0	352.77	
19800530	35401	94	AIR	3.7970	5014.28	21.84	21.76	662.973	795.554	375.014	177.768	-0.364	-0.042	0.30	0	352.73	
19800530	243988	95	AIR	3.7970	5014.28	21.81	21.83	658.064	795.769	375.054	177.859	-0.364	-0.042	0.29	0	346.71	
19800530	243988	95	AIR	3.7970	5014.28	21.97	21.83	658.130	795.769	375.030	177.859	-0.364	-0.042	0.29	0	346.62	
19800603	62206	96	AIR	3.7970	5014.28	21.96	21.72	647.824	796.661	375.032	177.728	-0.364	-0.042	0.30	0	333.26	
19800603	62206	96	AIR	3.7970	5014.28	21.99	21.72	647.818	796.661	375.040	177.728	-0.364	-0.042	0.30	0	333.21	
19800604	61130	97	AIR	3.7970	5014.28	21.79	21.98	652.862	796.715	375.054	177.813	-0.364	-0.042	0.31	0	339.95	
19800604	61130	97	AIR	3.7970	5014.28	21.97	21.98	653.003	796.715	375.030	177.813	-0.364	-0.042	0.31	0	339.93	
19800604	62206	98	AIR	3.7970	5014.28	22.08	21.88	648.118	797.606	375.044	177.807	-0.364	-0.042	0.30	0	333.19	
19800604	62206	98	AIR	3.7970	5014.28	22.08	21.88	648.069	797.606	375.028	177.807	-0.364	-0.042	0.30	0	333.15	
19800605	75934	99	SAIR	3.7970	5014.28	21.49	22.08	651.016	796.828	375.086	177.772	-0.364	-0.042	0.00	11	338.29	DRIFTING CYLINDER
19800605	75934	99	SAIR	3.7970	5014.28	21.70	22.08	651.162	796.828	375.052	177.772	-0.364	-0.042	0.00	11	338.25	DRIFTING CYLINDER
19800609	243988	100	AIR	3.7970	5014.28	22.07	21.86	657.972	795.093	375.043	177.798	-0.364	-0.042	0.29	0	346.67	
19800609	243988	100	AIR	3.7970	5014.28	22.13	21.86	658.052	795.093	375.018	177.798	-0.364	-0.042	0.29	0	346.72	
19800610	61130	101	AIR	3.7970	5014.28	21.89	22.09	651.996	794.773	375.046	177.706	-0.364	-0.042	0.31	0	339.92	
19800610	61130	101	AIR	3.7970	5014.28	22.03	22.09	652.056	794.773	375.028	177.706	-0.364	-0.042	0.31	0	339.84	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 5/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19800613	34770	102	AIR	3.7970	5014.28	21.80	21.70	652.696	798.487	375.050	177.700	-0.364	-0.042	0.29	0	338.39	
19800613	34770	102	AIR	3.7970	5014.28	21.83	21.70	652.702	798.487	375.034	177.700	-0.364	-0.042	0.29	0	338.38	
19800613	127524	103	SAIR	3.7970	5014.28	21.94	21.80	653.394	798.300	375.042	177.848	-0.364	-0.042	0.00	11	339.58	HG CONTACTED POINTER PREMATURELY
19800613	127524	103	SAIR	3.7970	5014.28	22.02	21.80	653.586	798.300	375.044	177.848	-0.364	-0.042	0.00	11	339.72	DRIFTING CYLINDER
19800616	127693	104	SAIR	3.7970	5014.28	22.07	21.91	670.429	797.247	375.058	177.808	-0.364	-0.042	0.00	11	360.98	HG CONTACTED POINTER PREMATURELY
19800616	127693	104	SAIR	3.7970	5014.28	22.07	21.91	670.502	797.247	375.019	177.808	-0.364	-0.042	0.00	11	361.11	DRIFTING CYLINDER
19800618	66556	105	AIR	3.7970	5014.28	22.16	22.05	458.129	795.680	375.024	177.730	-0.364	-0.042	0.37	0	101.02	
19800618	66556	105	AIR	3.7970	5014.28	22.15	22.05	458.118	795.680	375.032	177.730	-0.364	-0.042	0.37	0	101.00	
19800618	71251	106	AIR	3.7970	5014.28	22.19	22.13	550.573	799.468	375.028	177.764	-0.364	-0.042	0.34	0	213.19	
19800618	71251	106	AIR	3.7970	5014.28	22.13	22.13	550.507	799.468	375.036	177.764	-0.364	-0.042	0.34	0	213.15	HG CONTACTED POINTER PREMATURELY
19800619	39239	107	N2	3.7970	5014.28	21.86	22.15	646.899	797.614	375.044	177.848	-0.364	-0.042	0.00	0	332.63	
19800619	39239	107	N2	3.7970	5014.28	21.90	22.15	646.966	797.614	375.046	177.848	-0.364	-0.042	0.00	0	332.67	
19800619	39239	108	N2	3.7970	5014.28	22.03	21.85	647.789	798.090	375.076	177.728	-0.364	-0.042	0.00	0	332.81	
19800619	39239	108	N2	3.7970	5014.28	22.08	21.85	647.830	798.090	375.056	177.728	-0.364	-0.042	0.00	0	332.82	
19800620	1540	109	N2	3.7970	5014.28	21.98	22.04	685.324	796.639	375.024	177.700	-0.364	-0.042	0.00	11	380.03	
19800620	1540	109	N2	3.7970	5014.28	22.06	22.04	685.422	796.639	375.035	177.700	-0.364	-0.042	0.00	11	380.03	
19800624	1540	110	N2	3.7970	5014.28	22.12	21.64	685.738	795.532	375.053	177.702	-0.364	-0.042	0.00	0	380.45	
19800624	1540	110	N2	3.7970	5014.28	22.05	21.64	685.668	795.532	375.016	177.702	-0.364	-0.042	0.00	0	380.51	
19800625	35299	111	N2	3.7970	5014.28	21.97	22.07	714.217	797.756	375.042	177.824	-0.364	-0.042	0.00	0	414.91	
19800625	35299	111	N2	3.7970	5014.28	21.97	22.07	714.204	797.756	375.034	177.824	-0.364	-0.042	0.00	0	414.91	
19800625	35299	112	N2	3.7970	5014.28	22.32	21.96	713.628	795.440	375.058	177.775	-0.364	-0.042	0.00	0	415.00	
19800625	35299	112	N2	3.7970	5014.28	22.30	21.96	713.514	795.440	375.015	177.775	-0.364	-0.042	0.00	0	414.95	
19800626	35316	113	N2	3.7970	5014.28	21.88	22.30	761.232	799.739	375.025	177.815	-0.364	-0.042	0.00	11	471.69	
19800626	35316	113	N2	3.7970	5014.28	21.99	22.30	761.358	799.739	375.004	177.815	-0.364	-0.042	0.00	11	471.68	
19800626	35316	114	N2	3.7970	5014.28	22.28	21.93	761.475	797.028	375.022	177.704	-0.364	-0.042	0.00	0	472.66	
19800626	35316	114	N2	3.7970	5014.28	22.29	21.93	761.556	797.028	375.018	177.704	-0.364	-0.042	0.00	0	472.75	
19800627	3753	115	N2	3.7970	5014.28	21.90	22.29	575.810	796.145	375.052	177.652	-0.364	-0.042	0.00	0	246.00	
19800627	3753	115	N2	3.7970	5014.28	21.96	22.29	575.835	796.145	375.028	177.652	-0.364	-0.042	0.00	0	246.00	
19800627	3753	116	N2	3.7970	5014.28	22.12	21.92	575.764	794.767	375.061	177.717	-0.364	-0.042	0.00	0	245.99	HG CONTACTED POINTER PREMATURELY
19800627	3753	116	N2	3.7970	5014.28	22.20	21.92	575.778	794.767	375.038	177.717	-0.364	-0.042	0.00	0	245.96	
19800909	127524	117	SAIR	3.7970	5014.28	21.26	21.48	651.782	794.131	375.037	177.765	-0.364	-0.042	0.00	0	340.29	HG CONTACTED POINTER PREMATURELY
19800909	127524	117	SAIR	3.7970	5014.28	21.56	21.48	652.071	794.131	374.998	177.765	-0.364	-0.042	0.00	0	340.33	
19800909	127693	118	SAIR	3.7970	5014.28	21.89	21.52	669.801	794.690	375.012	177.714	-0.364	-0.042	0.00	0	361.43	
19800909	127693	118	SAIR	3.7970	5014.28	21.94	21.52	669.892	794.690	375.013	177.714	-0.364	-0.042	0.00	0	361.48	
19800910	75934	119	SAIR	3.7970	5014.28	21.44	21.91	652.038	797.602	375.032	177.902	-0.364	-0.042	0.00	0	339.11	
19800910	75934	119	SAIR	3.7970	5014.28	21.59	21.91	652.122	797.602	375.006	177.902	-0.364	-0.042	0.00	0	339.06	
19800910	2408	120	N2	3.7970	5014.28	22.14	21.49	536.180	795.764	375.028	177.770	-0.364	-0.042	0.00	0	196.75	HG CONTACTED POINTER PREMATURELY
19800910	2408	120	N2	3.7970	5014.28	22.07	21.49	536.137	795.764	375.024	177.770	-0.364	-0.042	0.00	0	196.75	HG CONTACTED POINTER PREMATURELY
19800911	75934	121	SAIR	3.7970	5014.28	21.63	22.08	653.824	801.582	375.034	177.738	-0.364	-0.042	0.00	0	339.01	HG CONTACTED POINTER PREMATURELY
19800911	75934	121	SAIR	3.7970	5014.28	21.72	22.08	653.930	801.582	375.040	177.738	-0.364	-0.042	0.00	0	339.02	HG JUMPING TOWARDS POINTER-
19800916	127524	122	SAIR	3.7970	5014.28	21.97	21.89	654.811	800.021	375.014	177.763	-0.364	-0.042	0.00	0	340.43	
19800916	127524	122	SAIR	3.7970	5014.28	22.08	21.89	654.953	800.021	374.996	177.763	-0.364	-0.042	0.00	0	340.49	
19800917	127693	123	SAIR	3.7970	5014.28	21.30	22.01	670.004	797.270	375.050	177.768	-0.364	-0.042	0.00	0	361.56	
19800917	127693	123	SAIR	3.7970	5014.28	21.53	22.01	670.174	797.270	375.011	177.768	-0.364	-0.042	0.00	0	361.51	
19800917	2408	124	N2	3.7970	5014.28	22.35	21.45	537.518	800.031	375.022	177.744	-0.364	-0.042	0.00	0	196.85	
19800917	2408	124	N2	3.7970	5014.28	22.59	21.45	537.640	800.031	374.997	177.744	-0.364	-0.042	0.00	0	196.86	
19800918	1540	125	N2	3.7970	5014.28	21.35	22.45	684.030	795.695	375.024	177.702	-0.364	-0.042	0.00	0	380.44	LARGE TEMPERATURE DRIFT
19800918	1540	125	N2	3.7970	5014.28	21.85	22.45	684.614	795.695	375.050	177.702	-0.364	-0.042	0.00	0	380.44	
19800923	35316	126	N2	3.7970	5014.28	22.04	21.66	761.642	797.620	375.035	177.699	-0.364	-0.042	0.00	11	472.35	HG JUMPING TOWARDS POINTER-PREMATURE CONTACT
19800923	35316	126	N2	3.7970	5014.28	22.06	21.66	761.604	797.620	374.998	177.699	-0.364	-0.042	0.00	11	472.31	TEMPERATURE DROPPING DURING MEASUREMENT
19800924	35316	127	N2	3.7970	5014.28	21.31	22.09	757.791	793.624	375.028	177.804	-0.364	-0.042	0.00	0	472.72	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 6/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19800924	35316	127	N2	3.7970	5014.28	21.54	22.09	758.066	793.624	375.003	177.804	-0.364	-0.042	0.00	0	472.70	
19801023	35316	128	N2	3.7970	5014.28	21.91	21.58	761.570	797.075	374.997	177.716	-0.364	-0.042	0.00	0	472.82	
19801023	35316	128	N2	3.7970	5014.28	21.96	21.58	761.620	797.075	374.966	177.716	-0.364	-0.042	0.00	0	472.83	
19801024	35316	129	N2	3.7970	5014.28	20.99	21.93	759.303	796.442	375.002	177.778	-0.364	-0.042	0.00	0	472.71	
19801024	35316	129	N2	3.7970	5014.28	21.16	21.93	759.533	796.442	374.990	177.778	-0.364	-0.042	0.00	0	472.72	
19801024	71286	130	AIR	3.7970	5014.28	21.75	21.08	618.378	796.980	375.011	177.783	-0.364	-0.042	0.32	0	296.57	HG CONTACTED POINTER PREMATURELY
19801024	71286	130	AIR	3.7970	5014.28	22.12	21.08	618.724	796.980	375.008	177.783	-0.364	-0.042	0.32	0	296.60	HG CONTACTED POINTER PREMATURELY
19801024	71286	130	AIR	3.7970	5014.28	22.18	21.08	618.748	796.980	374.984	177.783	-0.364	-0.042	0.32	0	296.60	
19801111	35452	131	SAIR	3.7970	5014.29	21.96	21.98	638.979	795.535	374.994	177.740	-0.364	-0.042	0.00	0	323.67	
19801111	35452	131	SAIR	3.7970	5014.29	22.05	21.98	639.089	795.535	374.994	177.740	-0.364	-0.042	0.00	0	323.70	
19801112	35452	132	SAIR	3.7970	5014.29	21.73	21.50	640.138	797.647	375.006	177.720	-0.364	-0.042	0.00	0	323.67	
19801112	35452	132	SAIR	3.7970	5014.29	21.73	21.50	640.106	797.647	374.984	177.720	-0.364	-0.042	0.00	0	323.66	
19801113	35441	133	SAIR	3.7970	5014.29	21.08	21.73	647.020	799.911	374.990	177.766	-0.364	-0.042	0.00	0	331.96	
19801113	35441	133	SAIR	3.7970	5014.29	21.19	21.73	647.054	799.911	374.968	177.766	-0.364	-0.042	0.00	0	331.89	
19801113	35441	134	SAIR	3.7970	5014.29	21.52	21.15	646.700	796.923	375.005	177.696	-0.364	-0.042	0.00	0	331.89	
19801113	35441	134	SAIR	3.7970	5014.29	21.58	21.15	646.746	796.923	374.995	177.696	-0.364	-0.042	0.00	0	331.89	
19801114	35442	135	SAIR	3.7970	5014.29	21.24	21.53	643.652	800.923	374.979	177.696	-0.364	-0.042	0.00	0	326.83	
19801114	35442	135	SAIR	3.7970	5014.29	21.39	21.53	643.751	800.923	374.958	177.696	-0.364	-0.042	0.00	0	326.80	
19801114	35442	136	SAIR	3.7970	5014.29	21.69	21.29	644.441	801.166	374.997	177.720	-0.364	-0.042	0.00	0	326.84	HG CONTACTED POINTER PREMATURELY
19801114	35442	136	SAIR	3.7970	5014.29	21.77	21.29	644.527	801.166	375.014	177.720	-0.364	-0.042	0.00	0	326.83	HG CONTACTED POINTER PREMATURELY
19801118	35389	137	SAIR	3.7970	5014.29	21.87	21.06	652.823	803.114	374.971	177.688	-0.364	-0.042	0.00	0	335.57	HG CONTACTED POINTER PREMATURELY
19801118	35389	137	SAIR	3.7970	5014.29	21.90	21.06	652.796	803.114	374.952	177.688	-0.364	-0.042	0.00	0	335.52	
19801119	35389	138	SAIR	3.7970	5014.29	21.10	21.89	651.382	803.698	374.958	177.732	-0.364	-0.042	0.00	0	335.47	
19801119	35389	138	SAIR	3.7970	5014.29	21.30	21.89	651.548	803.698	374.944	177.732	-0.364	-0.042	0.00	0	335.45	
19801119	35434	139	SAIR	3.7970	5014.29	21.83	21.20	641.177	800.971	374.952	177.730	-0.364	-0.042	0.00	11	322.82	
19801119	35434	139	SAIR	3.7970	5014.29	21.98	21.20	641.330	800.971	374.978	177.730	-0.364	-0.042	0.00	11	322.80	
19801120	35434	140	SAIR	3.7970	5014.29	21.89	21.08	643.115	803.034	374.990	177.714	-0.364	-0.042	0.00	0	323.84	HG CONTACTED POINTER PREMATURELY
19801120	35434	140	SAIR	3.7970	5014.29	22.15	21.08	643.347	803.034	374.984	177.714	-0.364	-0.042	0.00	0	323.82	
19801121	35434	141	SAIR	3.7970	5014.29	21.73	21.28	647.710	814.700	374.984	177.742	-0.364	-0.042	0.00	0	323.81	
19801121	35434	141	SAIR	3.7970	5014.29	21.82	21.28	647.772	814.700	374.969	177.742	-0.364	-0.042	0.00	0	323.80	
19810805	35401	142	AIR	3.7970	5014.3	21.79	21.94	662.572	795.238	375.008	177.737	-0.364	-0.042	0.30	0	352.70	
19810805	35401	142	AIR	3.7970	5014.3	22.22	21.94	663.032	795.238	375.015	177.737	-0.364	-0.042	0.30	0	352.71	
19810806	66556	143	AIR	3.7970	5014.3	21.51	22.19	457.924	796.524	375.028	177.794	-0.364	-0.042	0.37	0	100.92	
19810806	66556	143	AIR	3.7970	5014.3	21.69	22.19	457.999	796.524	375.018	177.794	-0.364	-0.042	0.37	0	100.96	HG CONTACTED POINTER PREMATURELY
19810806	71251	144	AIR	3.7970	5014.3	22.51	21.62	551.957	802.663	375.015	177.651	-0.364	-0.042	0.34	0	213.12	
19810806	71251	144	AIR	3.7970	5014.3	22.75	21.62	552.054	802.663	375.008	177.651	-0.364	-0.042	0.34	0	213.07	
19810807	71286	145	AIR	3.7970	5014.3	21.60	22.67	617.614	798.793	375.035	177.680	-0.364	-0.042	0.32	0	296.54	HG CONTACTED POINTER PREMATURELY
19810807	71286	145	AIR	3.7970	5014.3	21.82	22.67	617.732	798.793	374.981	177.680	-0.364	-0.042	0.32	0	296.51	
19810807	34819	146	AIR	3.7970	5014.3	22.54	21.69	581.128	795.073	375.013	177.790	-0.364	-0.042	0.24	0	251.69	
19810807	34819	146	AIR	3.7970	5014.3	22.79	21.69	581.248	795.073	374.994	177.790	-0.364	-0.042	0.24	0	251.64	
19810812	34819	147	AIR	3.7970	5014.3	21.56	21.70	582.128	800.488	374.856	177.621	-0.364	-0.042	0.24	0	251.73	
19810812	34819	147	AIR	3.7970	5014.3	21.73	21.70	582.249	800.488	374.839	177.621	-0.364	-0.042	0.24	0	251.74	HG CONTACTED POINTER PREMATURELY
19810812	71341	148	AIR	3.7970	5014.3	22.58	21.65	638.848	795.170	374.842	177.601	-0.364	-0.042	0.31	0	322.39	
19810812	71341	148	AIR	3.7970	5014.3	22.81	21.65	639.002	795.170	374.807	177.601	-0.364	-0.042	0.31	0	322.36	
19810813	71341	149	AIR	3.7970	5014.3	21.93	22.68	638.368	797.493	374.830	177.486	-0.364	-0.042	0.31	0	322.48	
19810813	71341	149	AIR	3.7970	5014.3	22.22	22.68	638.650	797.493	374.830	177.486	-0.364	-0.042	0.31	0	322.50	HG CONTACTED POINTER PREMATURELY
19810813	66638	150	AIR	3.7970	5014.3	23.28	22.07	650.530	792.013	374.842	177.609	-0.364	-0.042	0.31	0	338.11	
19810813	66638	150	AIR	3.7970	5014.3	23.52	22.07	650.712	792.013	374.804	177.609	-0.364	-0.042	0.31	0	338.09	
19810814	66638	151	AIR	3.7970	5014.3	24.04	23.40	652.562	797.910	374.844	177.544	-0.364	-0.042	0.31	0	338.02	LARGE TEMPERATURE DRIFT
19810814	66638	151	AIR	3.7970	5014.3	24.44	23.40	652.876	797.910	374.795	177.544	-0.364	-0.042	0.31	0	337.98	
19810814	66625	152	AIR	3.7970	5014.3	25.48	24.27	659.470	800.134	374.807	177.536	-0.364	-0.042	0.29	0	344.59	
19810814	66625	152	AIR	3.7970	5014.3	25.57	24.27	659.489	800.134	374.800	177.536	-0.364	-0.042	0.29	0	344.51	
19810818	66625	153	AIR	3.7970	5014.3	21.36	21.62	657.711	799.382	374.844	177.566	-0.364	-0.042	0.29	0	344.65	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 7/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19810818	66696	154	AIR	3.7970	5014.3	21.96	21.43	668.460	794.153	374.816	177.578	-0.364	-0.042	0.31	0	359.84	
19810818	66696	154	AIR	3.7970	5014.3	22.10	21.43	668.573	794.153	374.812	177.578	-0.364	-0.042	0.31	0	359.80	
19810819	66696	155	AIR	3.7970	5014.3	21.88	21.28	670.634	798.501	374.816	177.574	-0.364	-0.042	0.31	0	359.88	
19810819	66696	155	AIR	3.7970	5014.3	22.02	21.28	670.782	798.501	374.808	177.574	-0.364	-0.042	0.31	0	359.89	
19810820	67615	156	AIR	3.7970	5014.3	21.53	21.95	788.144	801.306	374.845	177.538	-0.364	-0.042	0.30	0	503.06	
19810820	67615	156	AIR	3.7970	5014.3	21.70	21.95	788.372	801.306	374.806	177.538	-0.364	-0.042	0.30	0	503.08	
19810820	67615	157	AIR	3.7970	5014.3	22.36	21.62	790.322	801.731	374.834	177.565	-0.364	-0.042	0.30	0	503.31	
19810820	67615	157	AIR	3.7970	5014.3	22.70	21.62	790.788	801.731	374.812	177.565	-0.364	-0.042	0.30	0	503.29	
19810824	71479	158	AIR	3.7970	5014.3	21.97	21.30	746.356	797.018	374.816	177.574	-0.364	-0.042	0.30	0	453.41	
19810824	71479	158	AIR	3.7970	5014.3	22.12	21.30	746.542	797.018	374.808	177.574	-0.364	-0.042	0.30	0	453.40	
19810825	71479	159	AIR	3.7970	5014.3	21.67	22.04	743.325	794.319	374.832	177.624	-0.364	-0.042	0.30	0	453.37	LARGE TEMPERATURE DRIFT
19810825	71479	159	AIR	3.7970	5014.3	22.06	22.04	743.786	794.319	374.802	177.624	-0.364	-0.042	0.30	0	453.34	LARGE TEMPERATURE DRIFT
19810825	71370	160	AIR	3.7970	5014.3	23.53	21.81	704.983	789.210	374.830	177.605	-0.364	-0.042	0.31	0	406.32	
19810825	71370	160	AIR	3.7970	5014.3	23.80	21.81	705.310	789.210	374.830	177.605	-0.364	-0.042	0.31	0	406.34	
19810826	71370	161	AIR	3.7970	5014.3	24.03	22.51	709.620	798.025	374.839	177.516	-0.364	-0.042	0.31	0	406.42	HG CONTACTED POINTER PREMATURELY
19810826	71370	161	AIR	3.7970	5014.3	24.29	22.51	709.858	798.025	374.792	177.516	-0.364	-0.042	0.31	0	406.38	
19810827	71308	162	AIR	3.7970	5014.3	22.35	24.14	680.914	796.954	374.842	177.583	-0.364	-0.042	0.32	0	376.53	
19810827	71308	162	AIR	3.7970	5014.3	22.84	24.14	681.364	796.954	374.804	177.583	-0.364	-0.042	0.32	0	376.47	
19810827	71308	163	AIR	3.7970	5014.3	24.01	22.60	680.876	790.024	374.831	177.589	-0.364	-0.042	0.32	0	376.43	
19810827	71308	163	AIR	3.7970	5014.3	24.31	22.60	681.176	790.024	374.828	177.589	-0.364	-0.042	0.32	0	376.40	
19820420	18027	164	AIR	3.7993	5014.3	21.57	22.12	649.868	799.182	374.950	177.654	-0.364	-0.042	0.00	0	335.92	HG CONTACTED POINTER PREMATURELY
19820420	18027	164	AIR	3.7993	5014.3	21.73	22.12	650.000	799.182	374.941	177.654	-0.364	-0.042	0.00	0	335.90	HG CONTACTED POINTER PREMATURELY
19820420	18040	165	AIR	3.7993	5014.3	22.23	21.65	648.728	794.325	374.995	177.686	-0.364	-0.042	0.00	0	335.76	HG CONTACTED POINTER PREMATURELY
19820421	18067	166	AIR	3.7993	5014.3	21.34	22.24	653.049	794.746	374.964	177.722	-0.364	-0.042	0.31	0	342.40	HG CONTACTED POINTER PREMATURELY
19820421	18067	166	AIR	3.7993	5014.3	21.44	22.24	653.060	794.746	374.931	177.722	-0.364	-0.042	0.31	0	342.33	
19820421	16410	167	AIR	3.7993	5014.3	22.27	21.39	663.741	798.924	374.962	177.752	-0.364	-0.042	0.00	0	351.31	
19820421	16410	167	AIR	3.7993	5014.3	22.35	21.39	663.802	798.924	374.944	177.752	-0.364	-0.042	0.00	0	351.30	
19820423	18042	168	AIR	3.7993	5014.3	22.77	21.90	656.436	797.678	374.989	177.666	-0.364	-0.042	0.00	0	343.01	HG CONTACTED POINTER PREMATURELY
19820423	18042	168	AIR	3.7993	5014.3	22.84	21.90	656.378	797.678	374.944	177.666	-0.364	-0.042	0.00	0	342.91	
19820423	16417	169	AIR	3.7993	5014.3	22.74	22.79	663.813	800.923	374.953	177.684	-0.364	-0.042	0.00	0	351.41	
19820423	16417	169	AIR	3.7993	5014.3	22.81	22.79	663.899	800.923	374.954	177.684	-0.364	-0.042	0.00	0	351.42	
19821104	39239	170	N2	3.7993	5014.31	23.00	22.74	649.005	801.351	374.954	177.586	-0.364	-0.042	0.00	11	332.72	
19821104	39239	170	N2	3.7993	5014.31	23.19	22.74	649.202	801.351	374.955	177.586	-0.364	-0.042	0.00	11	332.73	
19821105	39256	171	N2	3.7993	5014.31	22.73	21.91	658.576	797.665	374.949	177.582	-0.364	-0.042	0.00	0	345.74	
19821105	39256	171	N2	3.7993	5014.31	22.88	21.91	658.747	797.665	374.926	177.582	-0.364	-0.042	0.00	0	345.79	
19821108	39272	172	N2	3.7993	5014.31	22.48	22.03	671.714	800.336	374.929	177.565	-0.364	-0.042	0.00	0	360.74	
19821108	39272	172	N2	3.7993	5014.31	22.52	22.03	671.767	800.336	374.940	177.565	-0.364	-0.042	0.00	0	360.74	
19821110	39256	173	N2	3.7993	5014.31	21.84	21.48	659.630	800.609	374.940	177.563	-0.364	-0.042	0.00	0	345.96	
19821110	39256	173	N2	3.7993	5014.31	21.87	21.48	659.592	800.609	374.910	177.563	-0.364	-0.042	0.00	0	345.91	
19821110	39272	174	N2	3.7993	5014.31	21.77	21.86	672.194	802.583	374.940	177.680	-0.364	-0.042	0.00	0	360.78	
19821110	39272	174	N2	3.7993	5014.31	21.81	21.86	672.171	802.583	374.910	177.680	-0.364	-0.042	0.00	0	360.74	
19821111	39239	175	N2	3.7993	5014.31	21.89	21.78	647.392	797.686	374.968	177.596	-0.364	-0.042	0.00	0	332.88	HG CONTACTED POINTER PREMATURELY
19821111	39239	175	N2	3.7993	5014.31	21.95	21.78	647.392	797.686	374.924	177.596	-0.364	-0.042	0.00	0	332.86	
19821112	39272	176	N2	3.7993	5014.31	21.47	21.91	673.769	806.439	374.963	177.589	-0.364	-0.042	0.00	0	360.85	HG CONTACTED POINTER PREMATURELY
19821112	39272	176	N2	3.7993	5014.31	21.70	21.91	673.936	806.439	374.924	177.589	-0.364	-0.042	0.00	0	360.80	
19821112	39239	177	N2	3.7993	5014.31	22.09	21.57	650.564	803.951	374.934	177.622	-0.364	-0.042	0.00	0	332.96	
19821112	39239	177	N2	3.7993	5014.31	22.18	21.57	650.572	803.951	374.918	177.622	-0.364	-0.042	0.00	0	332.89	
19821112	3082	178	AIR	3.7993	5014.31	22.31	22.12	637.388	804.790	374.916	177.658	-0.364	-0.042	0.30	0	316.65	
19821112	3082	178	AIR	3.7993	5014.31	22.34	22.12	637.390	804.790	374.946	177.658	-0.364	-0.042	0.30	0	316.59	
19821115	39256	179	N2	3.7993	5014.31	22.23	21.63	660.065	801.205	374.978	177.614	-0.364	-0.042	0.00	0	345.84	
19821115	39256	179	N2	3.7993	5014.31	22.35	21.63	660.148	801.205	374.948	177.614	-0.364	-0.042	0.00	0	345.83	
19821115	3082	180	AIR	3.7993	5014.31	22.50	22.29	636.084	801.727	374.992	177.678	-0.364	-0.042	0.30	0	316.52	
19821115	3082	180	AIR	3.7993	5014.31	22.50	22.29	636.046	801.727	374.966	177.678	-0.364	-0.042	0.30	0	316.50	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 8/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19821116	3074	181	AIR	3.7993	5014.31	22.21	22.49	646.108	801.696	374.992	177.776	-0.364	-0.042	0.30	0	329.37	
19821116	3074	181	AIR	3.7993	5014.31	22.32	22.49	646.157	801.696	374.980	177.776	-0.364	-0.042	0.30	0	329.31	
19821116	3074	182	AIR	3.7993	5014.31	22.54	22.27	644.962	797.767	374.968	177.600	-0.364	-0.042	0.30	0	329.34	
19821116	3074	182	AIR	3.7993	5014.31	22.60	22.27	645.022	797.767	374.982	177.600	-0.364	-0.042	0.30	0	329.32	
19821117	3071	183	AIR	3.7993	5014.31	22.20	22.53	662.768	796.430	374.977	177.648	-0.364	-0.042	0.30	0	352.68	
19821117	3071	183	AIR	3.7993	5014.31	22.41	22.53	662.940	796.430	374.980	177.648	-0.364	-0.042	0.30	0	352.62	
19821117	3071	184	AIR	3.7993	5014.31	22.52	22.23	665.538	800.914	374.988	177.636	-0.364	-0.042	0.30	0	352.72	
19821117	3071	184	AIR	3.7993	5014.31	22.55	22.23	665.514	800.914	374.964	177.636	-0.364	-0.042	0.30	0	352.68	
19821118	3091	185	AIR	3.7993	5014.31	22.09	22.52	655.198	799.231	375.002	177.628	-0.364	-0.042	0.30	0	341.90	
19821118	3091	185	AIR	3.7993	5014.31	22.52	22.52	655.611	799.231	374.993	177.628	-0.364	-0.042	0.30	0	341.89	
19821118	3091	186	AIR	3.7993	5014.31	22.58	22.15	656.354	799.915	374.992	177.634	-0.364	-0.042	0.30	0	341.90	
19821118	3091	186	AIR	3.7993	5014.31	22.59	22.15	656.329	799.915	374.972	177.634	-0.364	-0.042	0.30	0	341.88	
19821119	3092	187	AIR	3.7993	5014.31	22.46	22.58	675.997	799.256	374.990	177.636	-0.364	-0.042	0.30	0	366.98	
19821119	3092	187	AIR	3.7993	5014.31	22.60	22.58	676.127	799.256	374.978	177.636	-0.364	-0.042	0.30	0	366.97	
19821119	3092	188	AIR	3.7993	5014.31	22.52	22.47	677.698	802.615	374.982	177.653	-0.364	-0.042	0.30	0	366.87	
19821119	3092	188	AIR	3.7993	5014.31	22.51	22.47	677.677	802.615	374.974	177.653	-0.364	-0.042	0.30	0	366.87	
19821120	34891	189	AIR	3.7993	5014.31	22.16	22.51	620.370	801.470	374.996	177.606	-0.364	-0.042	0.24	0	298.13	
19821120	34891	189	AIR	3.7993	5014.31	22.21	22.51	620.424	801.470	374.964	177.606	-0.364	-0.042	0.24	0	298.18	
19821121	34891	190	AIR	3.7993	5014.31	21.97	22.17	620.742	802.100	375.002	177.670	-0.364	-0.042	0.24	0	298.15	
19821121	34891	190	AIR	3.7993	5014.31	22.10	22.17	620.828	802.100	374.967	177.670	-0.364	-0.042	0.24	0	298.16	
19821122	62807	191	AIR	3.7993	5014.31	21.88	22.04	654.258	802.541	375.012	177.660	-0.364	-0.042	0.29	0	338.63	
19821122	62807	191	AIR	3.7993	5014.31	22.17	22.04	654.450	802.541	374.944	177.660	-0.364	-0.042	0.29	0	338.59	
19821122	62807	192	AIR	3.7993	5014.31	22.24	22.10	654.044	801.455	374.995	177.678	-0.364	-0.042	0.29	0	338.62	
19821122	62807	192	AIR	3.7993	5014.31	22.32	22.10	654.118	801.455	374.974	177.678	-0.364	-0.042	0.29	0	338.64	
19821123	62817	193	AIR	3.7993	5014.31	21.68	22.28	675.892	802.477	374.989	177.645	-0.364	-0.042	0.28	0	365.62	
19821123	62817	194	AIR	3.7993	5014.31	22.22	21.76	676.450	801.197	374.966	177.636	-0.364	-0.042	0.28	0	365.68	
19821123	62817	194	AIR	3.7993	5014.31	22.30	21.76	676.489	801.197	374.952	177.636	-0.364	-0.042	0.28	0	365.64	
19821123	62814	195	AIR	3.7993	5014.31	22.44	22.25	726.214	803.321	374.988	177.656	-0.364	-0.042	0.31	0	425.22	
19821123	62814	195	AIR	3.7993	5014.31	22.50	22.25	726.283	803.321	374.953	177.656	-0.364	-0.042	0.31	0	425.26	
19821124	62814	196	AIR	3.7993	5014.31	21.99	22.47	722.680	798.421	374.996	177.644	-0.364	-0.042	0.31	0	425.26	
19821124	62814	196	AIR	3.7993	5014.31	22.22	22.47	722.991	798.421	375.006	177.644	-0.364	-0.042	0.31	0	425.27	
19830817	39239	197	N2	3.7993	5014.32	22.53	23.33	647.458	800.009	374.993	177.594	-0.364	-0.042	0.00	0	332.76	
19830817	39239	197	N2	3.7993	5014.32	22.77	23.33	647.680	800.009	374.963	177.594	-0.364	-0.042	0.00	0	332.78	HG CONTACTED POINTER PREMATURELY
19830817	39272	198	N2	3.7993	5014.32	23.23	22.64	672.139	801.112	374.965	177.612	-0.364	-0.042	0.00	0	360.61	
19830817	39272	198	N2	3.7993	5014.32	23.43	22.64	672.332	801.112	374.950	177.612	-0.364	-0.042	0.00	0	360.61	
19830817	39272	199	N2	3.7993	5014.32	23.82	23.28	671.094	798.945	374.982	177.676	-0.364	-0.042	0.00	0	360.67	HG CONTACTED POINTER PREMATURELY
19830818	39272	199	N2	3.7993	5014.32	22.38	23.28	669.457	798.945	374.982	177.676	-0.364	-0.042	0.00	0	360.53	
19830822	39256	200	N2	3.7993	5014.32	21.91	21.57	663.374	808.933	375.024	177.698	-0.364	-0.042	0.00	0	345.90	HG CONTACTED POINTER PREMATURELY
19830822	39256	200	N2	3.7993	5014.32	22.07	21.57	663.454	808.933	375.000	177.698	-0.364	-0.042	0.00	0	345.82	
19830822	39256	200	N2	3.7993	5014.32	22.42	21.57	663.839	808.933	375.012	177.698	-0.364	-0.042	0.00	0	345.84	
19830823	39256	201	N2	3.7993	5014.32	22.54	21.98	661.814	804.852	375.024	177.687	-0.364	-0.042	0.00	10	345.98	POOR APPROACH-HG CONTROL LEAKING
19830823	39256	201	N2	3.7993	5014.32	22.67	21.98	661.644	804.852	374.980	177.687	-0.364	-0.042	0.00	0	345.66	
19830823	39256	201	N2	3.7993	5014.32	22.76	21.98	661.804	804.852	375.005	177.687	-0.364	-0.042	0.00	0	345.72	
19830823	71341	202	AIR	3.7993	5014.32	22.78	22.63	641.893	804.346	375.008	177.668	-0.364	-0.042	0.31	0	322.27	
19830823	71341	202	AIR	3.7993	5014.32	22.86	22.63	641.942	804.346	374.986	177.668	-0.364	-0.042	0.31	0	322.26	
19830824	71341	203	AIR	3.7993	5014.32	22.42	22.80	640.178	801.515	375.016	177.655	-0.364	-0.042	0.31	0	322.24	
19830824	71341	203	AIR	3.7993	5014.32	22.62	22.80	640.308	801.515	374.988	177.655	-0.364	-0.042	0.31	0	322.20	
19830824	66638	204	AIR	3.7993	5014.32	23.13	22.52	655.166	803.572	374.990	177.642	-0.364	-0.042	0.31	0	338.23	
19830824	66638	204	AIR	3.7993	5014.32	23.35	22.52	655.367	803.572	374.987	177.642	-0.364	-0.042	0.31	0	338.21	
19830829	66638	205	AIR	3.7993	5014.32	24.69	23.77	654.620	801.672	374.993	177.636	-0.364	-0.042	0.31	0	338.22	
19830829	66638	205	AIR	3.7993	5014.32	24.97	23.77	654.890	801.672	374.974	177.636	-0.364	-0.042	0.31	0	338.23	
19830830	6078	206	N2	3.7993	5014.32	23.83	24.82	630.120	801.880	374.992	177.671	-0.364	-0.042	0.00	0	310.83	TEMPERATURE DROPPING DURING MEASUREMENT

Table A7: Manometric Reference Gas Measurements: Original Data. Page 9/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 ^oC*	Temp Tot ^oC*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19830830	6078	206	N2	3.7993	5014.32	23.71	24.82	629.926	801.880	374.986	177.671	-0.364	-0.042	0.00	0	310.73	
19830830	6078	207	N2	3.7993	5014.32	23.29	23.78	628.416	796.836	374.954	177.672	-0.364	-0.042	0.00	0	310.76	
19830830	6078	207	N2	3.7993	5014.32	23.34	23.78	628.450	796.836	374.953	177.672	-0.364	-0.042	0.00	0	310.75	
19830831	66625	208	AIR	3.7993	5014.32	22.42	23.31	657.323	800.379	374.986	177.676	-0.364	-0.042	0.29	0	344.48	
19830831	66625	208	AIR	3.7993	5014.32	22.44	23.31	657.310	800.379	374.965	177.676	-0.364	-0.042	0.29	0	344.47	
19830831	66625	209	AIR	3.7993	5014.32	22.30	22.45	658.234	800.723	374.984	177.678	-0.364	-0.042	0.29	0	344.50	
19830831	66625	209	AIR	3.7993	5014.32	22.42	22.45	658.347	800.723	374.977	177.678	-0.364	-0.042	0.29	0	344.50	
19830920	2399	210	N2	3.7993	5014.32	22.89	22.29	643.980	805.522	374.984	177.614	-0.364	-0.042	0.00	0	324.01	
19830920	2399	210	N2	3.7993	5014.32	22.99	22.29	644.119	805.522	374.976	177.614	-0.364	-0.042	0.00	0	324.07	
19830921	2399	211	N2	3.7993	5014.32	22.09	22.93	642.946	806.469	375.010	177.712	-0.364	-0.042	0.00	0	323.96	
19830921	2399	211	N2	3.7993	5014.32	22.26	22.93	643.110	806.469	374.951	177.712	-0.364	-0.042	0.00	0	324.03	
19830921	66696	212	AIR	3.7993	5014.32	23.02	22.18	674.511	806.221	375.000	177.679	-0.364	-0.042	0.31	0	359.87	
19830921	66696	212	AIR	3.7993	5014.32	23.19	22.18	674.656	806.221	374.928	177.679	-0.364	-0.042	0.31	0	359.92	
19830922	66696	213	AIR	3.7993	5014.32	22.40	23.10	672.753	805.853	374.969	177.743	-0.364	-0.042	0.31	0	360.01	
19830922	66696	213	AIR	3.7993	5014.32	22.53	23.10	672.822	805.853	374.965	177.743	-0.364	-0.042	0.31	0	359.93	
19830926	39239	214	N2	3.7993	5014.32	21.95	21.98	651.204	806.998	374.992	177.712	-0.364	-0.042	0.00	0	332.76	
19830926	39239	214	N2	3.7993	5014.32	21.99	21.98	651.189	806.998	374.961	177.712	-0.364	-0.042	0.00	0	332.73	
19830926	71308	215	AIR	3.7993	5014.32	22.07	21.96	687.505	806.854	374.980	177.756	-0.364	-0.042	0.32	0	376.22	
19830926	71308	215	AIR	3.7993	5014.32	22.17	21.96	687.596	806.854	374.956	177.756	-0.364	-0.042	0.32	0	376.22	
19830928	71308	216	AIR	3.7993	5014.32	22.23	22.08	687.287	806.257	374.990	177.708	-0.364	-0.042	0.32	0	376.22	
19830928	71308	216	AIR	3.7993	5014.32	22.52	22.08	687.548	806.257	374.954	177.708	-0.364	-0.042	0.32	0	376.18	
19830928	1540	217	N2	3.7993	5014.32	23.00	22.39	690.080	804.416	374.974	177.746	-0.364	-0.042	0.00	0	380.48	
19830928	1540	217	N2	3.7993	5014.32	23.22	22.39	690.304	804.416	374.948	177.746	-0.364	-0.042	0.00	0	380.49	
19830929	1540	218	N2	3.7993	5014.32	22.82	23.12	687.675	801.750	374.956	177.749	-0.364	-0.042	0.00	0	380.44	
19830929	1540	218	N2	3.7993	5014.32	23.14	23.12	687.984	801.750	374.912	177.749	-0.364	-0.042	0.00	0	380.44	
19830929	71286	219	AIR	3.7993	5014.32	23.87	22.96	620.818	802.842	374.962	177.742	-0.364	-0.042	0.32	0	296.71	HG CONTACTED POINTER PREMATURELY
19830929	71286	219	AIR	3.7993	5014.32	24.10	22.96	620.918	802.842	374.932	177.742	-0.364	-0.042	0.32	0	296.62	
19830930	71286	220	AIR	3.7993	5014.32	22.62	23.98	618.518	801.911	374.966	177.633	-0.364	-0.042	0.32	0	296.70	
19830930	71286	220	AIR	3.7993	5014.32	22.87	23.98	618.704	801.911	374.912	177.633	-0.364	-0.042	0.32	0	296.72	
19830930	7366	221	N2	3.7993	5014.32	23.67	22.74	601.524	796.230	374.933	177.692	-0.364	-0.042	0.00	0	276.59	
19830930	7366	222	N2	3.7993	5014.32	24.42	23.76	603.530	802.491	374.944	177.719	-0.364	-0.042	0.00	0	276.52	
19830930	7366	222	N2	3.7993	5014.32	24.48	23.76	603.598	802.491	374.940	177.719	-0.364	-0.042	0.00	0	276.55	
19831004	71370	223	AIR	3.7993	5014.32	22.23	22.19	710.935	804.023	374.956	177.660	-0.364	-0.042	0.31	0	406.45	
19831004	71370	223	AIR	3.7993	5014.32	22.40	22.19	711.054	804.023	374.936	177.660	-0.364	-0.042	0.31	0	406.37	
19831004	71370	224	AIR	3.7993	5014.32	22.53	22.33	711.847	805.470	374.956	177.700	-0.364	-0.042	0.31	0	406.41	
19831004	71370	224	AIR	3.7993	5014.32	22.61	22.33	711.922	805.470	374.930	177.700	-0.364	-0.042	0.31	0	406.42	
19831005	35299	225	N2	3.7993	5014.32	22.12	22.57	718.144	805.920	374.984	177.708	-0.364	-0.042	0.00	0	415.03	
19831005	35299	225	N2	3.7993	5014.32	22.23	22.57	718.204	805.920	374.938	177.708	-0.364	-0.042	0.00	0	415.00	
19831005	35299	226	N2	3.7993	5014.32	22.38	22.17	719.065	806.080	374.953	177.745	-0.364	-0.042	0.00	0	415.13	HG CONTROL LEAKING-POSSIBLE
19831005	35299	226	N2	3.7993	5014.32	22.46	22.17	718.985	806.080	374.936	177.745	-0.364	-0.042	0.00	0	414.93	OVERESTIMATION
19831005	34819	227	AIR	3.7993	5014.32	22.38	22.42	584.722	807.952	374.966	177.669	-0.364	-0.042	0.24	0	251.82	
19831005	34819	227	AIR	3.7993	5014.32	22.46	22.42	584.762	807.952	374.960	177.669	-0.364	-0.042	0.24	0	251.80	
19831006	34819	228	AIR	3.7993	5014.32	21.99	22.42	583.729	805.797	374.976	177.738	-0.364	-0.042	0.24	0	251.85	
19831006	34819	228	AIR	3.7993	5014.32	22.10	22.42	583.746	805.797	374.934	177.738	-0.364	-0.042	0.24	0	251.82	
19831006	3753	229	N2	3.7993	5014.32	22.59	22.05	578.884	804.099	374.972	177.670	-0.364	-0.042	0.00	0	246.04	
19831006	3753	229	N2	3.7993	5014.32	22.79	22.05	579.102	804.099	374.944	177.670	-0.364	-0.042	0.00	0	246.16	HG CONTROL LEAKING-POSSIBLE
19831007	3753	230	N2	3.7993	5014.32	22.22	22.72	578.176	804.016	374.995	177.658	-0.364	-0.042	0.00	0	246.09	
19831007	3753	230	N2	3.7993	5014.32	22.38	22.72	578.245	804.016	374.950	177.658	-0.364	-0.042	0.00	0	246.09	
19831007	71479	231	AIR	3.7993	5014.32	22.52	22.31	750.369	805.064	374.960	177.594	-0.364	-0.042	0.30	0	453.29	
19831007	71479	231	AIR	3.7993	5014.32	22.63	22.31	750.516	805.064	374.958	177.594	-0.364	-0.042	0.30	0	453.30	
19831020	71479	232	AIR	3.7993	5014.32	22.19	21.86	750.416	804.646	374.984	177.608	-0.364	-0.042	0.30	0	453.44	
19831020	71479	232	AIR	3.7993	5014.32	22.32	21.86	750.565	804.646	374.938	177.608	-0.364	-0.042	0.30	0	453.47	
19831021	35316	233	N2	3.7993	5014.32	22.01	22.25	764.917	804.282	374.978	177.847	-0.364	-0.042	0.00	0	472.81	HG JUMPING-CONTACTED POINTER PREMATURELY

Table A7: Manometric Reference Gas Measurements: Original Data. Page 10/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19831021	35316	233	N2	3.7993	5014.32	22.15	22.25	764.986	804.282	374.956	177.847	-0.364	-0.042	0.00	0	472.68	
19831021	35316	234	N2	3.7993	5014.32	22.22	22.08	764.656	802.989	374.958	177.750	-0.364	-0.042	0.00	0	472.77	HG CONTACTED POINTER PREMATURELY
19831021	35316	234	N2	3.7993	5014.32	22.20	22.08	764.553	802.989	374.942	177.750	-0.364	-0.042	0.00	0	472.70	
19831021	71251	235	AIR	3.7993	5014.32	22.04	22.21	552.342	806.872	374.962	177.684	-0.364	-0.042	0.34	0	213.17	
19831021	71251	235	AIR	3.7993	5014.32	22.09	22.21	552.412	806.872	374.966	177.684	-0.364	-0.042	0.34	0	213.21	
19831025	71251	236	AIR	3.7993	5014.32	21.97	21.35	553.775	809.473	375.287	178.058	-0.364	-0.042	0.34	0	213.14	
19831025	71251	236	AIR	3.7993	5014.32	22.01	21.35	553.825	809.473	375.256	178.058	-0.364	-0.042	0.34	0	213.21	
19831025	2408	237	N2	3.7993	5014.32	22.05	21.97	538.004	803.300	375.311	178.130	-0.364	-0.042	0.00	0	196.88	
19831025	2408	237	N2	3.7993	5014.32	22.16	21.97	538.048	803.300	375.269	178.130	-0.364	-0.042	0.00	0	196.90	
19831026	2408	238	N2	3.7993	5014.32	21.70	22.10	518.752	730.181	375.324	178.048	-0.364	-0.042	0.00	0	196.78	
19831026	2408	238	N2	3.7993	5014.32	21.84	22.10	518.804	730.181	375.248	178.048	-0.364	-0.042	0.00	0	196.86	
19831026	67615	239	AIR	3.7993	5014.32	22.28	21.75	792.030	804.534	375.294	178.070	-0.364	-0.042	0.30	0	503.65	
19831026	67615	239	AIR	3.7993	5014.32	22.47	21.75	792.255	804.534	375.246	178.070	-0.364	-0.042	0.30	0	503.64	
19831027	67615	240	AIR	3.7993	5014.32	21.89	22.35	789.776	803.478	375.266	178.162	-0.364	-0.042	0.30	0	503.66	
19831027	67615	240	AIR	3.7993	5014.32	22.10	22.35	789.976	803.478	375.240	178.162	-0.364	-0.042	0.30	0	503.55	
19831027	2408	241	N2	3.7993	5014.32	22.39	21.97	537.170	799.498	375.260	178.046	-0.364	-0.042	0.00	0	196.86	
19831027	2408	241	N2	3.7993	5014.32	22.70	21.97	537.327	799.498	375.254	178.046	-0.364	-0.042	0.00	0	196.84	
19831027	39239	242	N2	3.7993	5014.32	22.74	22.47	651.038	805.703	375.268	178.002	-0.364	-0.042	0.00	0	332.70	
19831027	39239	242	N2	3.7993	5014.32	22.80	22.47	651.112	805.703	375.250	178.002	-0.364	-0.042	0.00	0	332.74	
19831031	66556	243	AIR	3.7993	5014.32	22.10	22.09	460.006	808.456	375.295	178.084	-0.364	-0.042	0.37	0	101.04	
19831031	66556	243	AIR	3.7993	5014.32	22.20	22.09	460.012	808.456	375.266	178.084	-0.364	-0.042	0.37	0	101.05	
19831101	66556	244	AIR	3.7993	5014.32	21.95	22.16	459.606	806.237	375.288	178.062	-0.364	-0.042	0.37	0	101.00	
19831101	66556	244	AIR	3.7993	5014.32	22.08	22.16	459.604	806.237	375.289	178.062	-0.364	-0.042	0.37	0	100.95	
19831108	39239	245	N2	3.7993	5014.32	22.24	21.77	652.839	809.382	375.325	178.141	-0.364	-0.042	0.00	0	332.70	
19831108	39239	245	N2	3.7993	5014.32	22.34	21.77	652.926	809.382	375.283	178.141	-0.364	-0.042	0.00	0	332.73	HG CONTACTED POINTER PREMATURELY
19831109	39239	246	N2	3.7993	5014.32	21.59	22.30	650.214	806.000	375.314	178.033	-0.364	-0.042	0.00	0	332.68	
19831109	39239	246	N2	3.7993	5014.32	21.75	22.30	650.339	806.000	375.284	178.033	-0.364	-0.042	0.00	0	332.67	
19831109	66625	247	AIR	3.7993	5014.32	22.19	21.65	663.180	809.619	375.295	178.102	-0.364	-0.042	0.29	0	344.61	
19831109	66625	247	AIR	3.7993	5014.32	22.30	21.65	663.216	809.619	375.284	178.102	-0.364	-0.042	0.29	0	344.53	
19831110	66625	248	AIR	3.7993	5014.32	21.92	22.27	665.740	817.272	375.290	178.088	-0.364	-0.042	0.29	0	344.61	
19831110	66625	248	AIR	3.7993	5014.32	22.13	22.27	665.920	817.272	375.282	178.088	-0.364	-0.042	0.29	0	344.58	
19840109	62807	249	AIR	3.7993	5014.32	21.24	21.52	659.627	814.660	375.294	177.938	-0.364	-0.042	0.29	0	338.55	
19840109	62807	249	AIR	3.7993	5014.32	21.31	21.52	659.661	814.660	375.283	177.938	-0.364	-0.042	0.29	0	338.52	HG CONTACTED POINTER PREMATURELY
19840110	62817	250	AIR	3.7993	5014.32	21.23	21.30	677.375	804.347	375.278	177.920	-0.364	-0.042	0.28	0	365.45	
19840110	62817	250	AIR	3.7993	5014.32	21.30	21.30	677.490	804.347	375.264	177.920	-0.364	-0.042	0.28	0	365.51	
19841030	39256	251	N2	3.7993	5014.33	21.62	21.88	657.301	797.171	374.996	177.592	-0.364	-0.042	0.00	0	345.74	
19841030	39256	251	N2	3.7993	5014.33	21.84	21.88	657.459	797.171	374.954	177.592	-0.364	-0.042	0.00	0	345.71	
19841030	11429	252	AIR	3.7993	5014.33	22.24	21.73	657.908	803.935	374.988	177.670	-0.364	-0.042	0.00	0	341.81	
19841030	11429	252	AIR	3.7993	5014.33	22.33	21.73	657.952	803.935	374.972	177.670	-0.364	-0.042	0.00	0	341.77	
19841030	11062	253	AIR	3.7993	5014.33	22.52	22.29	687.430	808.261	374.964	177.742	-0.364	-0.042	0.00	0	375.45	
19841030	11062	253	AIR	3.7993	5014.33	22.59	22.29	687.433	808.261	374.929	177.742	-0.364	-0.042	0.00	0	375.41	
19841031	11835	254	AIR	3.7993	5014.33	21.08	22.57	624.888	803.402	374.973	177.630	-0.364	-0.042	0.00	0	304.23	
19841031	11835	254	AIR	3.7993	5014.33	21.21	22.57	624.972	803.402	374.988	177.630	-0.364	-0.042	0.00	0	304.17	
19850206	83398	255	AIR	3.7934	5014.34	22.02	21.69	827.697	509.874	375.022	177.726	-0.303	-0.005	0.31	0	1031.86	
19850206	83398	255	AIR	3.7934	5014.34	22.13	21.69	827.764	509.874	375.010	177.726	-0.303	-0.005	0.31	0	1031.63	
19850612	11429	256	AIR	3.7934	5014.33	22.48	21.73	658.670	803.935	375.188	177.670	-0.303	-0.042	0.00	0	341.74	RERUN MEASUREMENT-SAMPLE STORED IN FLAME OFF TUBE
19850612	11429	256	AIR	3.7934	5014.33	22.62	21.73	658.737	803.935	375.176	177.670	-0.303	-0.042	0.00	0	341.66	RERUN MEASUREMENT-SAMPLE STORED
19850612	11062	257	AIR	3.7934	5014.33	22.60	22.29	688.147	808.261	375.192	177.742	-0.303	-0.042	0.00	0	375.43	RERUN MEASUREMENT-SAMPLE STORED IN FLAME OFF TUBE
19850612	11062	257	AIR	3.7934	5014.33	22.63	22.29	688.106	808.261	375.166	177.742	-0.303	-0.042	0.00	0	375.37	RERUN MEASUREMENT-SAMPLE STORED
19850612	11835	258	AIR	3.7934	5014.33	22.56	22.57	626.626	803.402	375.156	177.630	-0.303	-0.042	0.00	0	304.11	RERUN MEASUREMENT-SAMPLE STORED IN FLAME OFF TUBE

Table A7: Manometric Reference Gas Measurements: Original Data. Page 11/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19850612	11835	258	AIR	3.7934	5014.33	22.59	22.57	626.660	803.402	375.164	177.630	-0.303	-0.042	0.00	0	304.10	RERUN MEASUREMENT-SAMPLE STORED
19850614	8386	259	AIR	3.7934	5014.34	22.32	22.30	653.411	793.876	375.155	177.826	-0.303	-0.005	0.30	0	341.55	
19850614	8386	259	AIR	3.7934	5014.34	22.40	22.30	653.525	793.876	375.148	177.826	-0.303	-0.005	0.30	0	341.61	
19850614	8699	260	AIR	3.7934	5014.34	22.36	22.35	622.488	792.742	375.150	177.750	-0.303	-0.005	0.27	0	304.03	
19850614	8699	260	AIR	3.7934	5014.34	22.45	22.35	622.643	792.742	375.152	177.750	-0.303	-0.005	0.27	0	304.12	
19850617	8433	261	AIR	3.7934	5014.34	22.52	22.39	682.346	797.631	375.169	177.868	-0.303	-0.005	0.33	0	374.76	
19850617	8433	261	AIR	3.7934	5014.34	22.57	22.39	682.402	797.631	375.165	177.868	-0.303	-0.005	0.33	0	374.76	
19850619	39239	262	N2	3.7934	5014.34	22.49	22.25	646.623	794.981	375.165	177.767	-0.303	-0.005	0.00	0	332.62	
19850619	39239	262	N2	3.7934	5014.34	22.55	22.25	646.704	794.981	375.162	177.767	-0.303	-0.005	0.00	0	332.65	
19850620	39272	263	N2	3.7934	5014.34	22.44	22.51	668.286	793.553	375.146	177.832	-0.303	-0.005	0.00	0	360.54	
19850620	39272	263	N2	3.7934	5014.34	22.47	22.51	668.379	793.553	375.133	177.832	-0.303	-0.005	0.00	0	360.63	
19850621	39272	264	N2	3.7934	5014.34	22.30	22.45	667.343	791.596	375.161	177.824	-0.303	-0.005	0.00	0	360.60	
19850621	39272	264	N2	3.7934	5014.34	22.36	22.45	667.466	791.596	375.125	177.824	-0.303	-0.005	0.00	0	360.72	
19850625	39256	265	N2	3.7934	5014.34	22.52	22.63	657.727	796.749	375.162	177.812	-0.303	-0.005	0.00	0	345.74	
19850625	39256	265	N2	3.7934	5014.34	22.56	22.63	657.676	796.749	375.156	177.812	-0.303	-0.005	0.00	0	345.63	
19850626	39256	266	N2	3.7934	5014.34	22.33	22.54	657.174	795.779	375.156	177.820	-0.303	-0.005	0.00	0	345.74	
19850626	39256	266	N2	3.7934	5014.34	22.32	22.54	657.166	795.779	375.143	177.820	-0.303	-0.005	0.00	0	345.76	
19850626	71341	267	AIR	3.7934	5014.34	22.36	22.32	636.603	791.245	375.186	177.800	-0.303	-0.005	0.31	0	322.14	
19850626	71341	267	AIR	3.7934	5014.34	22.41	22.32	636.602	791.245	375.144	177.800	-0.303	-0.005	0.31	0	322.13	
19850626	71341	268	AIR	3.7934	5014.34	22.56	22.38	638.038	794.284	375.154	177.798	-0.303	-0.005	0.31	0	322.19	
19850626	71341	268	AIR	3.7934	5014.34	22.64	22.38	638.112	794.284	375.141	177.798	-0.303	-0.005	0.31	0	322.21	
19850627	66638	269	AIR	3.7934	5014.34	22.48	22.59	649.824	791.920	375.156	177.796	-0.303	-0.005	0.31	0	338.34	
19850627	66638	269	AIR	3.7934	5014.34	22.51	22.59	649.794	791.920	375.132	177.796	-0.303	-0.005	0.31	0	338.29	
19850710	66638	270	AIR	3.7934	5014.34	22.73	23.56	650.590	795.257	375.156	177.819	-0.303	-0.005	0.31	0	338.33	
19850710	66638	270	AIR	3.7934	5014.34	22.87	23.56	650.656	795.257	375.151	177.819	-0.303	-0.005	0.31	0	338.25	
19850710	6078	271	N2	3.7934	5014.34	23.43	22.81	628.619	793.274	375.152	177.732	-0.303	-0.005	0.00	0	310.93	
19850710	6078	271	N2	3.7934	5014.34	23.57	22.81	628.720	793.274	375.144	177.732	-0.303	-0.005	0.00	0	310.91	
19850711	6078	272	N2	3.7934	5014.34	22.77	23.47	628.620	796.174	375.160	177.724	-0.303	-0.005	0.00	0	310.92	
19850711	6078	272	N2	3.7934	5014.34	22.89	23.47	628.708	796.174	375.141	177.724	-0.303	-0.005	0.00	0	310.92	
19850711	66625	273	AIR	3.7934	5014.34	23.42	22.83	656.086	792.844	375.156	177.769	-0.303	-0.005	0.29	0	344.70	
19850711	66625	273	AIR	3.7934	5014.34	23.53	22.83	656.180	792.844	375.140	177.769	-0.303	-0.005	0.29	0	344.70	
19850712	66625	274	AIR	3.7934	5014.34	22.83	23.48	656.732	796.954	375.166	177.750	-0.303	-0.005	0.29	0	344.70	
19860712	66625	274	AIR	3.7934	5014.34	22.91	23.47	656.801	796.954	375.132	177.750	-0.303	-0.005	0.29	0	344.71	
19850712	2399	275	N2	3.7934	5014.34	23.21	22.88	638.640	792.376	375.140	177.705	-0.303	-0.005	0.00	0	324.07	
19850712	2399	275	N2	3.7934	5014.34	23.35	22.88	638.784	792.376	375.142	177.705	-0.303	-0.005	0.00	0	324.08	
19850729	2399	276	N2	3.7934	5014.34	22.93	22.61	639.194	794.043	375.140	177.742	-0.303	-0.005	0.00	0	323.91	
19850729	2399	276	N2	3.7934	5014.34	22.97	22.61	639.176	794.043	375.127	177.742	-0.303	-0.005	0.00	0	323.86	
19850730	18027	277	AIR	3.7934	5014.34	22.62	22.95	647.850	792.599	375.167	177.766	-0.303	-0.005	0.00	0	336.07	
19850730	18027	277	AIR	3.7934	5014.34	22.73	22.95	647.900	792.599	375.144	177.766	-0.303	-0.005	0.00	0	336.03	
19850730	18067	278	AIR	3.7934	5014.34	23.06	22.65	654.797	794.545	375.152	177.758	-0.303	-0.005	0.31	0	342.36	
19850730	18067	278	AIR	3.7934	5014.34	23.16	22.65	654.848	794.545	375.145	177.758	-0.303	-0.005	0.31	0	342.31	
19850731	16417	279	AIR	3.7934	5014.34	23.04	23.10	660.863	793.782	375.118	177.808	-0.303	-0.005	0.00	0	351.22	
19850731	16417	279	AIR	3.7934	5014.34	23.22	23.10	661.054	793.782	375.125	177.808	-0.303	-0.005	0.00	0	351.22	
19850731	39239	280	N2	3.7934	5014.34	23.23	23.14	647.659	797.378	375.124	177.735	-0.303	-0.005	0.00	0	332.81	
19850731	39239	280	N2	3.7934	5014.34	23.31	23.14	647.704	797.378	375.112	177.735	-0.303	-0.005	0.00	0	332.78	
19850801	66696	281	AIR	3.7934	5014.34	22.91	23.27	667.961	793.874	375.138	177.896	-0.303	-0.005	0.31	0	360.02	
19850801	66696	281	AIR	3.7934	5014.34	22.93	23.27	667.899	793.874	375.106	177.896	-0.303	-0.005	0.31	0	359.96	
19850801	66696	282	AIR	3.7934	5014.34	22.92	22.92	668.727	794.438	375.116	177.734	-0.303	-0.005	0.31	0	360.11	
19850801	66696	282	AIR	3.7934	5014.34	22.94	22.92	668.754	794.438	375.116	177.734	-0.303	-0.005	0.31	0	360.11	
19850805	71308	283	AIR	3.7934	5014.34	22.73	22.43	683.148	797.427	375.159	177.868	-0.303	-0.005	0.32	11	375.66	
19850805	71308	283	AIR	3.7934	5014.34	22.81	22.43	683.209	797.427	375.122	177.868	-0.303	-0.005	0.32	11	375.67	
19850806	71308	284	AIR	3.7934	5014.34	22.36	22.76	682.976	797.713	375.155	177.832	-0.303	-0.005	0.32	0	376.20	
19850806	71308	284	AIR	3.7934	5014.34	22.46	22.76	683.057	797.713	375.138	177.832	-0.303	-0.005	0.32	0	376.18	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 12/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19850806	1540	285	N2	3.7934	5014.34	22.76	22.39	686.373	796.210	375.158	177.768	-0.303	-0.005	0.00	0	380.56	
19850806	1540	285	N2	3.7934	5014.34	22.84	22.39	686.488	796.210	375.133	177.768	-0.303	-0.005	0.00	0	380.62	
19850807	1540	286	N2	3.7934	5014.34	22.70	22.80	685.572	795.364	375.157	177.669	-0.303	-0.005	0.00	0	380.67	
19850807	1540	286	N2	3.7934	5014.34	22.72	22.80	685.514	795.364	375.122	177.669	-0.303	-0.005	0.00	0	380.62	
19850807	71286	287	AIR	3.7934	5014.34	22.79	22.71	617.361	794.780	375.127	177.880	-0.303	-0.005	0.32	0	296.68	
19850807	71286	287	AIR	3.7934	5014.34	22.90	22.71	617.392	794.780	375.102	177.880	-0.303	-0.005	0.32	0	296.63	
19850807	71286	288	AIR	3.7934	5014.34	23.16	22.84	618.912	798.142	375.120	177.749	-0.303	-0.005	0.32	0	296.66	
19850807	71286	288	AIR	3.7934	5014.34	23.43	22.84	619.151	798.142	375.128	177.749	-0.303	-0.005	0.32	0	296.66	
19850812	71308	289	AIR	3.7934	5014.34	22.37	22.13	683.071	797.028	375.130	177.835	-0.303	-0.005	0.32	11	375.90	
19850812	71308	289	AIR	3.7934	5014.34	22.44	22.13	683.208	797.028	375.115	177.835	-0.303	-0.005	0.32	11	375.99	
19850813	7366	290	N2	3.7934	5014.34	22.61	22.40	602.550	799.158	375.122	177.755	-0.303	-0.005	0.00	0	276.68	
19850813	7366	290	N2	3.7934	5014.34	22.64	22.40	602.508	799.158	375.102	177.755	-0.303	-0.005	0.00	0	276.62	
19850813	7366	291	N2	3.7934	5014.34	22.53	22.62	600.960	795.570	375.136	177.748	-0.303	-0.005	0.00	0	276.61	
19850813	7366	291	N2	3.7934	5014.34	22.56	22.62	600.936	795.570	375.102	177.748	-0.303	-0.005	0.00	0	276.59	
19850813	71370	292	AIR	3.7934	5014.34	22.95	22.55	709.354	799.190	375.104	177.696	-0.303	-0.005	0.31	0	406.41	
19850813	71370	292	AIR	3.7934	5014.34	23.06	22.55	709.488	799.190	375.096	177.696	-0.303	-0.005	0.31	0	406.43	
19850814	71370	293	AIR	3.7934	5014.34	24.02	23.00	708.851	796.857	375.101	177.772	-0.303	-0.005	0.31	0	406.48	
19850814	71370	293	AIR	3.7934	5014.34	24.14	23.00	708.984	796.857	375.110	177.772	-0.303	-0.005	0.31	0	406.45	
19850814	35299	294	N2	3.7934	5014.34	23.64	24.10	712.963	795.598	375.101	177.800	-0.303	-0.005	0.00	0	414.90	HG CONTACTED POINTER PREMATURELY
19850814	35299	294	N2	3.7934	5014.34	23.68	24.10	713.092	795.598	375.104	177.800	-0.303	-0.005	0.00	0	414.99	
19850814	35299	295	N2	3.7934	5014.34	23.40	23.65	713.126	795.372	375.086	177.764	-0.303	-0.005	0.00	0	414.94	
19850814	35299	295	N2	3.7934	5014.34	23.45	23.65	713.194	795.372	375.085	177.764	-0.303	-0.005	0.00	0	414.95	
19850819	71308	296	AIR	3.7934	5014.34	22.31	22.05	683.032	796.525	374.910	177.595	-0.303	-0.005	0.32	0	376.26	
19850819	71308	296	AIR	3.7934	5014.34	22.44	22.05	683.174	796.525	374.896	177.595	-0.303	-0.005	0.32	0	376.27	
19850820	39239	297	N2	3.7934	5014.34	22.70	22.39	647.224	796.288	374.914	177.587	-0.303	-0.005	0.00	0	332.78	
19850820	39239	297	N2	3.7934	5014.34	22.75	22.39	647.241	796.288	374.894	177.587	-0.303	-0.005	0.00	0	332.77	
19850820	34819	298	AIR	3.7934	5014.34	22.68	22.72	580.944	795.682	374.916	177.574	-0.303	-0.005	0.24	0	251.87	
19850820	34819	298	AIR	3.7934	5014.34	22.71	22.72	580.941	795.682	374.874	177.574	-0.303	-0.005	0.24	0	251.89	
19850820	34819	299	AIR	3.7934	5014.34	22.54	22.69	581.280	797.353	374.900	177.637	-0.303	-0.005	0.24	0	251.74	
19850821	34819	299	AIR	3.7934	5014.34	22.64	22.69	581.306	797.353	374.908	177.637	-0.303	-0.005	0.24	0	251.68	
19850821	3753	300	N2	3.7934	5014.34	22.65	22.58	575.920	795.349	374.916	177.601	-0.303	-0.005	0.00	0	246.01	HG CONTACTED POINTER PREMATURELY
19850821	3753	300	N2	3.7934	5014.34	22.68	22.58	576.031	795.349	374.910	177.601	-0.303	-0.005	0.00	0	246.13	
19850821	3753	301	N2	3.7934	5014.34	22.65	22.67	575.822	795.029	374.888	177.598	-0.303	-0.005	0.00	0	246.13	
19850821	3753	301	N2	3.7934	5014.34	22.71	22.67	575.882	795.029	374.914	177.598	-0.303	-0.005	0.00	0	246.12	
19850827	71479	302	AIR	3.7934	5014.34	23.14	22.98	745.836	796.446	374.962	177.595	-0.303	-0.005	0.30	0	453.46	
19850827	71479	302	AIR	3.7934	5014.34	23.20	22.98	745.824	796.446	374.938	177.595	-0.303	-0.005	0.30	0	453.37	
19850827	71479	303	AIR	3.7934	5014.34	23.12	23.16	743.680	793.554	374.957	177.616	-0.303	-0.005	0.30	0	453.27	
19850827	71479	303	AIR	3.7934	5014.34	23.20	23.16	743.799	793.554	374.922	177.616	-0.303	-0.005	0.30	0	453.33	
19850828	35316	304	N2	3.7934	5014.34	23.08	23.15	761.173	796.800	374.949	177.664	-0.303	-0.005	0.00	0	472.82	
19850828	35316	304	N2	3.7934	5014.34	23.15	23.15	761.212	796.800	374.910	177.664	-0.303	-0.005	0.00	0	472.80	
19850828	35316	305	N2	3.7934	5014.34	23.13	23.10	758.595	792.540	374.938	177.660	-0.303	-0.005	0.00	0	472.75	
19850828	35316	305	N2	3.7934	5014.34	23.20	23.10	758.534	792.540	374.912	177.660	-0.303	-0.005	0.00	0	472.59	HG CONTACTED POINTER PREMATURELY
19850829	71251	306	AIR	3.7934	5014.34	22.50	23.16	549.080	795.561	374.918	177.584	-0.303	-0.005	0.34	0	213.19	
19850829	71251	306	AIR	3.7934	5014.34	22.64	23.16	549.135	795.561	374.894	177.584	-0.303	-0.005	0.34	0	213.18	
19850829	71251	307	AIR	3.7934	5014.34	23.71	22.57	549.080	791.880	374.928	177.610	-0.303	-0.005	0.34	0	213.09	
19850829	71251	307	AIR	3.7934	5014.34	23.97	22.57	549.238	791.880	374.918	177.610	-0.303	-0.005	0.34	0	213.10	
19850903	2408	308	N2	3.7934	5014.34	22.18	22.04	535.486	793.650	374.969	177.630	-0.303	-0.005	0.00	0	196.83	
19850903	2408	308	N2	3.7934	5014.34	22.25	22.04	535.498	793.650	374.944	177.630	-0.303	-0.005	0.00	0	196.83	
19850904	2408	309	N2	3.7934	5014.34	22.40	22.20	535.340	793.029	374.942	177.623	-0.303	-0.005	0.00	0	196.84	
19850904	2408	309	N2	3.7934	5014.34	22.43	22.20	535.272	793.029	374.916	177.623	-0.303	-0.005	0.00	0	196.77	
19850904	67615	310	AIR	3.7934	5014.34	22.60	22.41	784.788	793.725	374.905	177.598	-0.303	-0.005	0.30	0	503.52	
19850904	67615	310	AIR	3.7934	5014.34	22.63	22.41	784.913	793.725	374.896	177.598	-0.303	-0.005	0.30	0	503.63	
19850905	67615	311	AIR	3.7934	5014.34	22.47	22.61	785.737	795.577	374.924	177.568	-0.303	-0.005	0.30	0	503.73	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 13/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19850905	67615	311	AIR	3.7934	5014.34	22.50	22.61	785.767	795.577	374.903	177.568	-0.303	-0.005	0.30	0	503.74	
19850905	66556	312	AIR	3.7934	5014.34	22.33	22.48	457.691	793.955	374.906	177.576	-0.303	-0.005	0.37	0	100.95	
19850905	66556	312	AIR	3.7934	5014.34	22.36	22.48	457.696	793.955	374.904	177.576	-0.303	-0.005	0.37	0	100.94	
19850906	66556	313	AIR	3.7934	5014.34	21.99	22.34	457.749	795.009	374.916	177.613	-0.303	-0.005	0.37	0	100.91	HG CONTACTED POINTER PREMATURELY
19850906	66556	313	AIR	3.7934	5014.34	22.04	22.34	457.736	795.009	374.889	177.613	-0.303	-0.005	0.37	0	100.91	
19850906	39239	314	N2	3.7934	5014.34	22.06	22.00	647.118	796.725	374.898	177.578	-0.303	-0.005	0.00	0	332.73	
19850906	39239	314	N2	3.7934	5014.34	22.12	22.00	647.154	796.725	374.892	177.578	-0.303	-0.005	0.00	0	332.71	
19850910	83230	315	AIR	3.7934	5014.34	22.36	22.31	533.387	794.960	374.897	177.599	-0.303	-0.005	0.30	0	193.66	
19850910	83230	315	AIR	3.7934	5014.34	22.40	22.31	533.408	794.960	374.909	177.599	-0.303	-0.005	0.30	0	193.64	
19850911	83230	316	AIR	3.7934	5014.34	22.07	22.38	533.017	794.236	374.889	177.590	-0.303	-0.005	0.30	0	193.69	
19850911	83230	316	AIR	3.7934	5014.34	22.10	22.38	533.042	794.236	374.894	177.590	-0.303	-0.005	0.30	0	193.69	
19850911	83369	317	AIR	3.7934	5014.34	22.26	22.08	596.611	793.595	374.902	177.602	-0.303	-0.005	0.29	0	271.78	
19850911	83369	317	AIR	3.7934	5014.34	22.33	22.08	596.631	793.595	374.826	177.602	-0.303	-0.005	0.29	0	271.83	
19850911	83369	318	AIR	3.7934	5014.34	22.41	22.29	597.644	796.584	374.878	177.598	-0.303	-0.005	0.29	0	271.82	
19850911	83369	318	AIR	3.7934	5014.34	22.47	22.29	597.703	796.584	374.865	177.598	-0.303	-0.005	0.29	0	271.85	
19850916	83377	319	AIR	3.7934	5014.34	22.00	21.48	641.044	796.740	374.912	177.614	-0.303	-0.005	0.30	0	324.41	
19850916	83377	319	AIR	3.7934	5014.34	22.08	21.48	641.082	796.740	374.892	177.614	-0.303	-0.005	0.30	0	324.39	
19850918	83377	320	AIR	3.7934	5014.34	22.23	22.03	640.720	796.906	374.930	177.696	-0.303	-0.005	0.30	0	324.32	
19850918	83377	320	AIR	3.7934	5014.34	22.26	22.03	640.787	796.906	374.868	177.696	-0.303	-0.005	0.30	0	324.44	
19850919	83378	321	AIR	3.7934	5014.34	22.14	22.24	659.852	793.302	374.894	177.632	-0.303	-0.005	0.30	0	350.18	
19850919	83378	321	AIR	3.7934	5014.34	22.18	22.24	659.906	793.302	374.874	177.632	-0.303	-0.005	0.30	0	350.22	
19850920	83378	322	AIR	3.7934	5014.34	22.27	22.16	661.660	796.535	374.903	177.628	-0.303	-0.005	0.30	0	350.29	
19850920	83378	322	AIR	3.7934	5014.34	22.29	22.16	661.638	796.535	374.877	177.628	-0.303	-0.005	0.30	0	350.27	
19850920	83379	323	AIR	3.7934	5014.34	22.21	22.28	680.138	795.603	374.900	177.570	-0.303	-0.005	0.31	0	373.72	
19850920	83379	323	AIR	3.7934	5014.34	22.25	22.28	680.176	795.603	374.844	177.570	-0.303	-0.005	0.31	0	373.78	
19850920	83379	324	AIR	3.7934	5014.34	22.29	22.22	681.092	797.256	374.886	177.556	-0.303	-0.005	0.31	0	373.71	
19850920	83379	324	AIR	3.7934	5014.34	22.33	22.22	681.188	797.256	374.899	177.556	-0.303	-0.005	0.31	0	373.76	
19850925	83382	325	AIR	3.7934	5014.34	22.14	22.41	701.712	799.467	374.934	177.590	-0.303	-0.005	0.31	0	398.00	
19850925	83382	325	AIR	3.7934	5014.34	22.18	22.41	701.682	799.467	374.892	177.590	-0.303	-0.005	0.31	0	397.96	
19850925	83382	326	AIR	3.7934	5014.34	22.23	22.16	698.930	793.728	374.900	177.598	-0.303	-0.005	0.31	0	397.84	
19850925	83382	326	AIR	3.7934	5014.34	22.30	22.16	699.086	793.728	374.916	177.598	-0.303	-0.005	0.31	0	397.92	
19850925	83389	327	AIR	3.7934	5014.34	22.63	22.25	792.356	794.707	374.907	177.479	-0.303	-0.005	0.31	0	511.58	HG CONTACTED POINTER PREMATURELY
19850925	83389	327	AIR	3.7934	5014.34	22.74	22.25	792.525	794.707	374.889	177.479	-0.303	-0.005	0.31	0	511.61	
19850926	83389	328	AIR	3.7934	5014.34	22.18	22.68	791.494	795.295	374.917	177.562	-0.303	-0.005	0.31	0	511.71	
19850926	83389	328	AIR	3.7934	5014.34	22.24	22.68	791.569	795.295	374.894	177.562	-0.303	-0.005	0.31	0	511.72	
19850926	11835	329	AIR	3.7934	5014.34	22.32	22.21	623.843	796.441	374.902	177.568	-0.303	-0.005	0.00	0	304.25	
19850926	11835	329	AIR	3.7934	5014.34	22.36	22.21	623.776	796.441	374.896	177.568	-0.303	-0.005	0.00	0	304.13	
19850927	11429	330	AIR	3.7934	5014.34	22.30	22.34	653.850	795.355	374.908	177.567	-0.303	-0.005	0.00	0	341.81	
19850927	11429	330	AIR	3.7934	5014.34	22.34	22.34	653.825	795.355	374.914	177.567	-0.303	-0.005	0.00	0	341.72	HG CONTACTED POINTER PREMATURELY
19850927	11062	331	AIR	3.7934	5014.34	22.13	22.32	680.404	793.845	374.910	177.553	-0.303	-0.005	0.00	0	375.56	
19850927	11062	331	AIR	3.7934	5014.34	22.23	22.32	680.472	793.845	374.888	177.553	-0.303	-0.005	0.00	0	375.54	
19851212	18067	332	AIR	3.7934	5014.35	20.58	19.83	654.261	792.926	374.776	177.489	-0.303	-0.005	0.31	0	342.51	HG CONTACTED POINTER PREMATURELY
19851212	18067	332	AIR	3.7934	5014.35	20.73	19.83	654.505	792.926	374.756	177.489	-0.303	-0.005	0.31	0	342.65	
19851212	16417	333	AIR	3.7934	5014.35	21.24	20.68	648.712	766.487	374.790	177.464	-0.303	-0.005	0.00	0	351.28	HG CONTACTED POINTER PREMATURELY
19851212	16417	333	AIR	3.7934	5014.35	21.33	20.68	648.928	766.487	374.770	177.464	-0.303	-0.005	0.00	0	351.47	
19851213	18027	334	AIR	3.7934	5014.35	21.04	21.27	646.053	788.886	374.800	177.502	-0.303	-0.005	0.00	0	336.08	
19851213	18027	334	AIR	3.7934	5014.35	21.18	21.27	646.204	788.886	374.798	177.502	-0.303	-0.005	0.00	0	336.10	
19851217	18067	335	AIR	3.7934	5014.35	22.03	19.83	655.725	792.926	374.810	177.489	-0.303	-0.005	0.31	0	342.47	RERUN M'MENT ON F.O.T. SAMPLE-HG CONTACTED POINTER PREMATURELY
19851217	18067	335	AIR	3.7934	5014.35	22.12	19.83	655.751	792.926	374.791	177.489	-0.303	-0.005	0.31	0	342.42	RERUN M'MENT-SAMPLE NO. 2 STORED IN FLAME OFF TUBE
19851217	18067	335	AIR	3.7934	5014.35	22.17	19.83	655.856	792.926	374.801	177.489	-0.303	-0.005	0.31	0	342.47	RERUN M'MENT ON F.O.T. SAMPLE - FANS OFF DURING MEASUREMENT

Table A7: Manometric Reference Gas Measurements: Original Data. Page 14/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19851217	18067	335	AIR	3.7934	5014.35	22.17	19.83	655.787	792.926	374.778	177.489	-0.303	-0.005	0.31	0	342.42	RERUN M'MENT-SAMPLE NO. 2 STORED
19851218	16417	336	AIR	3.7934	5014.35	21.45	20.68	648.894	766.487	374.792	177.464	-0.303	-0.005	0.00	0	351.25	RERUN M'MENT-SAMPLE NO. 2 STORED IN FLAME OFF TUBE
19851218	16417	336	AIR	3.7934	5014.35	21.45	20.68	648.944	766.487	374.792	177.464	-0.303	-0.005	0.00	0	351.31	RERUN M'MENT-SAMPLE NO. 2 STORED
19851218	18027	337	AIR	3.7934	5014.35	21.63	21.27	646.572	788.886	374.838	177.502	-0.303	-0.005	0.00	0	335.96	RERUN M'MENT-SAMPLE NO. 2 STORED IN FLAME OFF TUBE
19851218	18027	337	AIR	3.7934	5014.35	21.63	21.27	646.525	788.886	374.810	177.502	-0.303	-0.005	0.00	0	335.94	RERUN M'MENT-SAMPLE NO. 2 STORED
19860211	83398	338	AIR	3.7934	5014.35	20.94	20.92	824.260	507.544	374.901	177.556	-0.303	-0.005	0.31	0	1032.16	
19860211	83398	338	AIR	3.7934	5014.35	21.05	20.92	824.394	507.544	374.872	177.556	-0.303	-0.005	0.31	0	1032.12	
19860211	83391	339	AIR	3.7934	5014.35	21.38	20.99	784.422	682.015	374.908	177.536	-0.303	-0.005	0.30	0	614.08	
19860211	83391	339	AIR	3.7934	5014.35	21.44	20.99	784.696	682.015	374.881	177.536	-0.303	-0.005	0.30	0	614.40	
19860212	83391	340	AIR	3.7934	5014.35	21.74	21.41	782.222	679.084	374.880	177.504	-0.303	-0.005	0.30	0	614.47	
19860212	83391	340	AIR	3.7934	5014.35	21.78	21.41	782.220	679.084	374.896	177.504	-0.303	-0.005	0.30	0	614.35	
19860213	83392	341	AIR	3.7934	5014.35	21.62	21.76	779.308	544.101	374.915	177.527	-0.303	-0.005	0.30	0	836.24	
19860213	83392	341	AIR	3.7934	5014.35	21.67	21.76	779.334	544.101	374.894	177.527	-0.303	-0.005	0.30	0	836.19	
19860214	83392	342	AIR	3.7934	5014.35	21.92	21.65	659.041	542.435	374.904	177.560	-0.303	-0.005	0.30	11	588.67	REJECT- LOST CO2 DURING EXTRACTION
19860219	83392	343	AIR	3.7934	5014.35	21.88	21.77	787.850	551.593	374.945	177.652	-0.303	-0.005	0.30	0	836.32	
19860219	83392	343	AIR	3.7934	5014.35	21.93	21.77	788.014	551.593	374.953	177.652	-0.303	-0.005	0.30	0	836.49	
19860220	83412	344	AIR	3.7934	5014.35	21.33	21.91	781.596	420.318	374.966	177.646	-0.303	-0.005	0.31	0	1272.45	
19860220	83412	344	AIR	3.7934	5014.35	21.43	21.91	781.674	420.318	374.945	177.646	-0.303	-0.005	0.31	0	1272.30	
19860220	83412	345	AIR	3.7934	5014.35	21.50	21.38	771.553	413.771	374.955	177.632	-0.303	-0.005	0.31	0	1272.09	
19860220	83412	345	AIR	3.7934	5014.35	21.54	21.38	771.654	413.771	374.956	177.632	-0.303	-0.005	0.31	0	1272.23	
19860221	83398	346	AIR	3.7934	5014.35	21.57	21.52	784.594	478.399	374.788	177.604	-0.303	-0.005	0.31	0	1032.20	
19860221	83398	346	AIR	3.7934	5014.35	21.61	21.52	784.638	478.399	374.780	177.604	-0.303	-0.005	0.31	0	1032.18	
19860221	2405	347	AIR	3.7934	5014.35	21.58	21.59	788.676	426.030	374.776	177.503	-0.303	-0.005	0.30	0	1262.19	
19860221	2405	347	AIR	3.7934	5014.35	21.69	21.59	788.900	426.030	374.775	177.503	-0.303	-0.005	0.30	0	1262.38	
19870331	39256	348	N2	3.7934	5014.36	21.77	21.15	650.692	780.177	374.848	177.456	-0.303	-0.005	0.00	0	345.67	HG CONTACTED POINTER PREMATURELY
19870331	39256	348	N2	3.7934	5014.36	21.80	21.15	650.680	780.177	374.800	177.456	-0.303	-0.005	0.00	0	345.68	
19870401	4826	349	AIR	3.7934	5014.36	21.73	21.78	639.483	783.194	374.860	177.510	-0.303	-0.005	0.00	0	330.71	
19870402	4826	349	AIR	3.7934	5014.36	21.40	21.78	639.308	783.194	374.828	177.510	-0.303	-0.005	0.00	0	330.92	
19870402	4826	350	AIR	3.7934	5014.36	21.82	21.77	639.510	783.023	374.822	177.469	-0.303	-0.005	0.00	0	330.74	
19870402	4826	350	AIR	3.7934	5014.36	21.93	21.77	639.668	783.023	374.798	177.469	-0.303	-0.005	0.00	0	330.84	
19870402	4827	351	AIR	3.7934	5014.36	21.99	21.86	647.514	785.881	374.826	177.466	-0.303	-0.005	0.00	0	339.07	
19870402	4827	351	AIR	3.7934	5014.36	22.04	21.86	647.640	785.881	374.792	177.466	-0.303	-0.005	0.00	0	339.20	
19870403	4827	352	AIR	3.7934	5014.36	21.45	22.01	650.386	793.611	374.823	177.488	-0.303	-0.005	0.00	0	339.20	
19870403	4827	352	AIR	3.7934	5014.36	21.51	22.01	650.452	793.611	374.800	177.488	-0.303	-0.005	0.00	0	339.24	
19870408	4828	353	AIR	3.7934	5014.36	21.72	21.48	658.131	787.409	374.828	177.532	-0.303	-0.005	0.00	0	351.32	
19870408	4828	353	AIR	3.7934	5014.36	21.85	21.48	658.262	787.409	374.822	177.532	-0.303	-0.005	0.00	0	351.33	
19870408	4828	354	AIR	3.7934	5014.36	21.80	21.75	657.514	786.437	374.836	177.512	-0.303	-0.005	0.00	0	351.33	
19870408	4828	354	AIR	3.7934	5014.36	21.84	21.75	657.510	786.437	374.807	177.512	-0.303	-0.005	0.00	0	351.31	
19870409	4829	355	AIR	3.7934	5014.36	21.10	21.81	666.356	781.944	374.830	177.490	-0.303	-0.005	0.00	0	366.04	
19870409	4829	355	AIR	3.7934	5014.36	21.27	21.81	666.540	781.944	374.795	177.490	-0.303	-0.005	0.00	0	366.09	
19870409	4829	356	AIR	3.7934	5014.36	21.70	21.16	672.363	791.502	374.843	177.490	-0.303	-0.005	0.00	0	366.13	
19870409	4829	356	AIR	3.7934	5014.36	21.79	21.16	672.502	791.502	374.833	177.490	-0.303	-0.005	0.00	0	366.19	
19870527	39256	357	N2	3.7934	5014.36	21.21	21.62	653.146	788.201	374.874	177.515	-0.303	-0.005	0.00	0	345.45	HG CONTACTED POINTER PREMATURELY
19870527	39256	357	N2	3.7934	5014.36	21.35	21.62	653.309	788.201	374.822	177.515	-0.303	-0.005	0.00	0	345.54	
19870527	34891	358	AIR	3.7934	5014.36	21.87	21.25	614.801	784.818	374.848	177.534	-0.303	-0.005	0.24	0	298.04	
19870527	34891	358	AIR	3.7934	5014.36	22.00	21.25	614.850	784.818	374.816	177.534	-0.303	-0.005	0.24	0	298.00	
19870528	34891	359	AIR	3.7934	5014.36	21.56	21.92	614.069	785.238	374.844	177.570	-0.303	-0.005	0.24	0	297.99	
19870528	34891	359	AIR	3.7934	5014.36	21.65	21.92	614.126	785.238	374.836	177.570	-0.303	-0.005	0.24	0	297.98	
19870528	62814	360	AIR	3.7934	5014.36	21.81	21.60	717.223	787.334	374.868	177.491	-0.303	-0.005	0.31	0	424.56	HG CONTACTED POINTER PREMATURELY
19870528	62814	360	AIR	3.7934	5014.36	21.91	21.60	717.342	787.334	374.847	177.491	-0.303	-0.005	0.31	0	424.58	-FAN VIBRATION TROUBLE
19870529	62814	361	AIR	3.7934	5014.36	21.88	21.84	717.222	787.829	374.850	177.578	-0.303	-0.005	0.31	0	424.56	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 15/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19870529	62814	361	AIR	3.7934	5014.36	21.95	21.84	717.325	787.829	374.856	177.578	-0.303	-0.005	0.31	0	424.57	
19870602	62807	362	AIR	3.7934	5014.36	21.97	21.78	646.668	784.429	374.866	177.538	-0.303	-0.005	0.29	0	338.45	
19870602	62807	362	AIR	3.7934	5014.36	22.03	21.78	646.712	784.429	374.844	177.538	-0.303	-0.005	0.29	0	338.46	
19870602	62807	363	AIR	3.7934	5014.36	21.97	21.99	647.278	786.350	374.870	177.511	-0.303	-0.005	0.29	0	338.37	
19870602	62807	363	AIR	3.7934	5014.36	22.03	21.99	647.359	786.350	374.828	177.511	-0.303	-0.005	0.29	0	338.45	
19870603	62817	364	AIR	3.7934	5014.36	21.53	21.98	669.158	788.066	374.866	177.566	-0.303	-0.005	0.28	0	365.24	
19870603	62817	364	AIR	3.7934	5014.36	21.65	21.98	669.264	788.066	374.830	177.566	-0.303	-0.005	0.28	0	365.26	
19870603	62817	365	AIR	3.7934	5014.36	21.85	21.58	669.539	787.117	374.862	177.512	-0.303	-0.005	0.28	0	365.31	
19870603	62817	365	AIR	3.7934	5014.36	21.95	21.58	669.680	787.117	374.852	177.512	-0.303	-0.005	0.28	0	365.37	
19870604	39256	366	N2	3.7934	5014.36	21.72	21.88	654.420	790.170	374.868	177.518	-0.303	-0.005	0.00	0	345.62	
19870604	39256	366	N2	3.7934	5014.36	21.90	21.88	654.596	790.170	374.883	177.518	-0.303	-0.005	0.00	0	345.59	
19880308	11094	367	N2	3.7934	5014.37	21.34	21.11	638.540	786.953	374.840	177.394	-0.303	-0.005	0.00	0	327.16	
19880308	11094	367	N2	3.7934	5014.37	21.42	21.11	638.642	786.953	374.843	177.394	-0.303	-0.005	0.00	0	327.19	
19880308	7358	368	N2	3.7934	5014.37	21.50	21.38	662.811	790.451	374.845	177.360	-0.303	-0.005	0.00	0	355.44	HG CONTACTED POINTER PREMATURELY
19880308	7358	368	N2	3.7934	5014.37	21.54	21.38	662.814	790.451	374.820	177.360	-0.303	-0.005	0.00	0	355.42	
19880309	7358	369	N2	3.7934	5014.37	21.31	21.52	663.284	792.283	374.842	177.382	-0.303	-0.005	0.00	0	355.40	
19880309	7358	369	N2	3.7934	5014.37	21.35	21.52	663.326	792.283	374.825	177.382	-0.303	-0.005	0.00	0	355.42	
19880309	11094	370	N2	3.7934	5014.37	21.27	21.32	640.392	791.850	374.868	177.456	-0.303	-0.005	0.00	0	327.16	HG CONTACTED POINTER PREMATURELY
19880309	11094	370	N2	3.7934	5014.37	21.34	21.32	640.363	791.850	374.840	177.456	-0.303	-0.005	0.00	0	327.08	
19880310	75593	371	N2	3.7934	5014.37	20.92	21.29	640.120	790.337	374.875	177.459	-0.303	-0.005	0.00	0	328.01	
19880310	75593	371	N2	3.7934	5014.37	21.00	21.29	640.150	790.337	374.837	177.459	-0.303	-0.005	0.00	0	328.00	
19880310	75593	372	N2	3.7934	5014.37	20.99	20.94	639.312	787.640	374.848	177.478	-0.303	-0.005	0.00	0	328.00	
19880310	75593	372	N2	3.7934	5014.37	21.04	20.94	639.380	787.640	374.856	177.478	-0.303	-0.005	0.00	0	328.01	
19880315	39361	373	N2	3.7934	5014.37	21.16	21.02	661.099	787.754	374.850	177.514	-0.303	-0.005	0.00	0	354.94	
19880315	39361	373	N2	3.7934	5014.37	21.29	21.02	661.238	787.754	374.804	177.514	-0.303	-0.005	0.00	0	355.00	
19880315	39361	374	N2	3.7934	5014.37	21.21	21.26	660.926	787.896	374.820	177.398	-0.303	-0.005	0.00	0	354.85	
19880315	39361	374	N2	3.7934	5014.37	21.27	21.26	660.964	787.896	374.830	177.398	-0.303	-0.005	0.00	0	354.81	
19880726	2401	375	AIR	3.7934	5014.38	21.68	21.76	779.872	779.178	374.926	177.472	-0.303	-0.005	0.30	0	509.87	
19880726	2401	375	AIR	3.7934	5014.38	21.75	21.76	779.968	779.178	374.890	177.472	-0.303	-0.005	0.30	0	509.90	
19880726	64329	376	AIR	3.7934	5014.38	21.74	21.71	761.176	605.048	374.889	177.490	-0.303	-0.005	0.30	0	684.25	
19880726	64329	376	AIR	3.7934	5014.38	21.76	21.71	761.223	605.048	374.876	177.490	-0.303	-0.005	0.30	0	684.31	
19880727	34790	377	AIR	3.7934	5014.38	21.76	21.76	762.641	515.543	374.907	177.616	-0.303	-0.005	0.30	0	869.21	
19880727	34790	377	AIR	3.7934	5014.38	21.92	21.76	762.920	515.543	374.880	177.616	-0.303	-0.005	0.30	0	869.40	
19890131	11094	378	N2	3.7934	5014.38	20.41	20.73	637.606	786.272	374.754	177.388	-0.303	-0.005	0.00	0	327.11	
19890131	11094	378	N2	3.7934	5014.38	20.53	20.73	637.824	786.272	374.774	177.388	-0.303	-0.005	0.00	0	327.22	
19890131	11094	379	N2	3.7934	5014.38	20.96	20.45	637.912	784.913	374.788	177.422	-0.303	-0.005	0.00	0	327.23	
19890131	11094	379	N2	3.7934	5014.38	21.04	20.45	638.002	784.913	374.750	177.422	-0.303	-0.005	0.00	0	327.29	
19890201	6052	380	N2	3.7934	5014.38	20.80	20.99	661.483	786.174	374.788	177.417	-0.303	-0.005	0.00	0	356.79	HG CONTACTED POINTER PREMATURELY
19890201	6052	380	N2	3.7934	5014.38	20.85	20.99	661.582	786.174	374.758	177.417	-0.303	-0.005	0.00	0	356.88	
19890206	6052	381	N2	3.7934	5014.38	20.35	20.03	664.953	792.789	374.752	177.363	-0.303	-0.005	0.00	0	356.60	HG CONTACTED POINTER PREMATURELY
19890206	6052	381	N2	3.7934	5014.38	20.42	20.03	665.170	792.789	374.721	177.363	-0.303	-0.005	0.00	0	356.81	
19890206	11092	382	N2	3.7934	5014.38	20.40	20.38	640.633	787.734	374.744	177.725	-0.303	-0.005	0.00	0	329.89	
19890206	11092	382	N2	3.7934	5014.38	20.45	20.38	640.733	787.734	374.714	177.725	-0.303	-0.005	0.00	0	329.99	
19890207	11092	383	N2	3.7934	5014.38	20.60	20.42	641.340	788.864	374.768	177.420	-0.303	-0.005	0.00	0	329.77	
19890207	11092	383	N2	3.7934	5014.38	20.69	20.42	641.395	788.864	374.740	177.420	-0.303	-0.005	0.00	0	329.77	
19890710	75593	384	N2	3.7934	5014.39	21.68	21.60	638.154	783.933	375.086	177.796	-0.303	-0.005	0.00	0	328.39	
19890710	75593	384	N2	3.7934	5014.39	21.77	21.60	638.188	783.933	375.097	177.796	-0.303	-0.005	0.00	0	328.31	
19890711	75593	385	N2	3.7934	5014.39	21.13	21.72	638.398	786.001	375.128	177.779	-0.303	-0.005	0.00	0	328.31	
19890711	75593	385	N2	3.7934	5014.39	21.28	21.72	638.481	786.001	375.084	177.779	-0.303	-0.005	0.00	0	328.29	HG CONTACTED POINTER PREMATURELY
19890711	39361	386	N2	3.7934	5014.39	21.64	21.17	660.428	784.925	375.040	177.756	-0.303	-0.005	0.00	0	355.24	
19890711	39361	386	N2	3.7934	5014.39	21.75	21.17	660.484	784.925	375.049	177.756	-0.303	-0.005	0.00	0	355.15	
19890712	39361	387	N2	3.7934	5014.39	21.52	21.69	659.730	784.795	375.084	177.694	-0.303	-0.005	0.00	0	355.16	
19890712	39361	387	N2	3.7934	5014.39	21.69	21.69	659.866	784.795	375.098	177.694	-0.303	-0.005	0.00	0	355.10	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 16/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19900320	6052	388	N2	3.7934	5014.4	21.98	22.11	661.795	786.250	375.115	177.870	-0.303	-0.005	0.00	0	356.90	
19900320	6052	388	N2	3.7934	5014.4	22.07	22.11	661.878	786.250	375.111	177.870	-0.303	-0.005	0.00	0	356.90	
19900320	6052	389	N2	3.7934	5014.4	21.91	22.02	662.256	787.136	375.140	177.862	-0.303	-0.005	0.00	0	356.90	
19900320	6052	389	N2	3.7934	5014.4	21.99	22.02	662.344	787.136	375.108	177.862	-0.303	-0.005	0.00	0	356.94	
19900321	11081	390	N2	3.7934	5014.4	21.65	21.94	661.754	784.870	375.157	177.912	-0.303	-0.005	0.00	0	357.84	
19900321	11081	390	N2	3.7934	5014.4	21.83	21.94	661.890	784.870	375.118	177.912	-0.303	-0.005	0.00	0	357.83	
19900321	11081	391	N2	3.7934	5014.4	21.82	21.72	661.782	784.121	375.134	177.801	-0.303	-0.005	0.00	0	357.78	
19900321	11081	391	N2	3.7934	5014.4	22.00	21.72	661.986	784.121	375.107	177.801	-0.303	-0.005	0.00	0	357.84	
19900322	39239	392	N2	3.7934	5014.4	21.75	21.86	643.557	788.740	375.162	177.916	-0.303	-0.005	0.00	0	332.71	
19900322	39239	392	N2	3.7934	5014.4	21.84	21.86	643.653	788.740	375.137	177.916	-0.303	-0.005	0.00	0	332.76	
19900322	39272	393	N2	3.7934	5014.4	21.72	21.79	664.877	786.819	375.156	177.878	-0.303	-0.005	0.00	10	360.29	
19900322	39272	393	N2	3.7934	5014.4	21.81	21.79	665.128	786.819	375.140	177.878	-0.303	-0.005	0.00	0	360.51	
19900322	39272	394	N2	3.7934	5014.4	21.75	21.75	666.198	789.123	375.154	177.909	-0.303	-0.005	0.00	0	360.51	
19900322	39272	394	N2	3.7934	5014.4	21.86	21.75	666.300	789.123	375.145	177.909	-0.303	-0.005	0.00	0	360.50	
19900327	39256	395	N2	3.7934	5014.4	21.60	21.35	652.988	785.736	375.212	177.878	-0.303	-0.005	0.00	0	345.61	HG CONTACTED POINTER PREMATURELY
19900327	39256	395	N2	3.7934	5014.4	21.73	21.35	653.120	785.736	375.167	177.878	-0.303	-0.005	0.00	0	345.67	
19900328	39256	396	N2	3.7934	5014.4	21.93	21.66	654.457	788.938	375.188	177.961	-0.303	-0.005	0.00	0	345.68	
19900328	39256	396	N2	3.7934	5014.4	22.04	21.66	654.468	788.938	375.152	177.961	-0.303	-0.005	0.00	0	345.60	
19900328	71341	397	AIR	3.7934	5014.4	21.77	21.99	632.979	783.689	375.178	177.891	-0.303	-0.005	0.31	0	321.98	
19900328	71341	397	AIR	3.7934	5014.4	21.90	21.99	633.116	783.689	375.164	177.891	-0.303	-0.005	0.31	0	322.02	
19900328	71341	398	AIR	3.7934	5014.4	21.70	21.80	632.438	782.181	375.190	177.962	-0.303	-0.005	0.31	0	321.99	
19900328	71341	398	AIR	3.7934	5014.4	21.76	21.80	632.553	782.181	375.189	177.962	-0.303	-0.005	0.31	0	322.06	
19900402	11092	399	N2	3.7934	5014.4	21.76	21.51	640.936	786.978	375.177	177.858	-0.303	-0.005	0.00	0	329.93	
19900402	11092	399	N2	3.7934	5014.4	21.86	21.51	641.036	786.978	375.168	177.858	-0.303	-0.005	0.00	0	329.95	
19900403	11092	400	N2	3.7934	5014.4	21.47	21.80	641.015	788.229	375.236	177.918	-0.303	-0.005	0.00	0	330.00	
19900403	11092	400	N2	3.7934	5014.4	21.65	21.80	641.176	788.229	375.217	177.918	-0.303	-0.005	0.00	0	330.01	
19900403	73292	401	N2	3.7934	5014.4	21.71	21.55	640.871	786.391	375.230	177.936	-0.303	-0.005	0.00	0	330.25	HG CONTACTED POINTER PREMATURELY
19900403	73292	401	N2	3.7934	5014.4	21.84	21.55	641.028	786.391	375.225	177.936	-0.303	-0.005	0.00	0	330.30	
19900404	73292	402	N2	3.7934	5014.4	21.92	21.76	640.124	784.560	375.270	177.952	-0.303	-0.005	0.00	0	330.27	
19900404	73292	402	N2	3.7934	5014.4	22.02	21.76	640.174	784.560	375.274	177.952	-0.303	-0.005	0.00	0	330.21	
19900409	66638	403	AIR	3.7934	5014.4	21.64	21.34	649.611	790.665	375.288	178.024	-0.303	-0.005	0.31	0	338.23	
19900409	66638	403	AIR	3.7934	5014.4	21.80	21.34	649.807	790.665	375.285	178.024	-0.303	-0.005	0.31	0	338.29	
19900410	66638	404	AIR	3.7934	5014.4	21.68	21.70	648.888	789.472	375.315	177.902	-0.303	-0.005	0.31	0	338.28	
19900410	66638	404	AIR	3.7934	5014.4	21.87	21.70	649.095	789.472	375.280	177.902	-0.303	-0.005	0.31	0	338.35	
19900410	6078	405	N2	3.7934	5014.4	21.80	21.75	625.932	788.160	375.300	178.025	-0.303	-0.005	0.00	0	310.80	
19900410	6078	405	N2	3.7934	5014.4	21.92	21.75	626.044	788.160	375.292	178.025	-0.303	-0.005	0.00	0	310.82	
19900410	6078	406	N2	3.7934	5014.4	21.87	21.85	627.253	791.509	375.272	178.030	-0.303	-0.005	0.00	0	310.81	
19900410	6078	406	N2	3.7934	5014.4	22.01	21.85	627.384	791.509	375.288	178.030	-0.303	-0.005	0.00	0	310.80	
19900417	66625	407	AIR	3.7934	5014.4	21.87	21.73	651.245	783.525	375.322	177.980	-0.303	-0.005	0.29	0	344.42	
19900417	66625	407	AIR	3.7934	5014.4	21.97	21.73	651.420	783.525	375.283	177.980	-0.303	-0.005	0.29	0	344.57	
19900418	66625	408	AIR	3.7934	5014.4	21.82	21.92	650.812	782.955	375.300	177.998	-0.303	-0.005	0.29	0	344.54	
19900418	66625	408	AIR	3.7934	5014.4	21.94	21.92	650.894	782.955	375.282	177.998	-0.303	-0.005	0.29	0	344.52	
19900418	2399	409	N2	3.7934	5014.4	21.99	21.86	633.678	781.334	375.284	178.064	-0.303	-0.005	0.00	0	324.01	
19900418	2399	409	N2	3.7934	5014.4	22.11	21.86	633.734	781.334	375.266	178.064	-0.303	-0.005	0.00	0	323.96	
19900419	2399	410	N2	3.7934	5014.4	21.68	22.05	634.952	785.520	375.310	177.985	-0.303	-0.005	0.00	0	323.87	
19900419	2399	410	N2	3.7934	5014.4	21.86	22.05	635.232	785.520	375.305	177.985	-0.303	-0.005	0.00	0	324.02	
19900419	39239	411	N2	3.7934	5014.4	21.74	21.71	642.939	786.850	375.304	178.041	-0.303	-0.005	0.00	0	332.70	
19900420	39239	411	N2	3.7934	5014.4	21.74	21.71	642.979	786.850	375.335	178.041	-0.303	-0.005	0.00	0	332.71	
19900510	66696	412	AIR	3.7934	5014.4	21.10	22.00	664.865	788.100	375.296	178.012	-0.303	-0.005	0.31	0	360.15	HG CONTACTED POINTER PREMATURELY
19900510	66696	412	AIR	3.7934	5014.4	21.27	22.00	664.989	788.100	375.280	178.012	-0.303	-0.005	0.31	0	360.11	
19900510	66696	413	AIR	3.7934	5014.4	21.25	21.17	663.734	784.386	375.304	178.009	-0.303	-0.005	0.31	11	359.66	HG CONTACTED POINTER PREMATURELY
19900510	66696	413	AIR	3.7934	5014.4	21.39	21.17	664.033	784.386	375.261	178.009	-0.303	-0.005	0.31	11	359.91	
19900511	71308	414	AIR	3.7934	5014.4	21.79	21.31	677.304	784.483	375.314	177.966	-0.303	-0.005	0.32	0	376.00	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 17/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19900511	71308	414	AIR	3.7934	5014.4	21.87	21.31	677.313	784.483	375.273	177.966	-0.303	-0.005	0.32	0	375.95	
19900511	71308	415	AIR	3.7934	5014.4	21.60	21.83	675.312	782.248	375.285	178.035	-0.303	-0.005	0.32	0	375.93	
19900511	71308	415	AIR	3.7934	5014.4	21.70	21.83	675.556	782.248	375.288	178.035	-0.303	-0.005	0.32	0	376.09	
19900511	1540	416	N2	3.7934	5014.4	21.52	21.64	679.810	784.325	375.298	178.004	-0.303	-0.005	0.00	0	380.45	
19900511	1540	416	N2	3.7934	5014.4	21.62	21.64	679.989	784.325	375.273	178.004	-0.303	-0.005	0.00	0	380.57	
19900521	1540	417	N2	3.7934	5014.4	21.48	21.43	680.464	784.731	375.312	177.938	-0.303	-0.005	0.00	0	380.72	
19900522	1540	417	N2	3.7934	5014.4	21.63	21.43	680.536	784.731	375.295	177.938	-0.303	-0.005	0.00	0	380.63	
19900522	66696	418	AIR	3.7934	5014.4	21.65	21.52	663.595	783.184	375.305	178.004	-0.303	-0.005	0.31	0	360.13	
19900522	66696	418	AIR	3.7934	5014.4	21.77	21.52	663.578	783.184	375.308	178.004	-0.303	-0.005	0.31	0	359.95	
19900523	71286	419	AIR	3.7934	5014.4	21.72	21.68	612.890	782.953	375.340	178.060	-0.303	-0.005	0.32	0	296.75	
19900523	71286	419	AIR	3.7934	5014.4	21.90	21.68	612.946	782.953	375.320	178.060	-0.303	-0.005	0.32	0	296.65	
19900523	71286	420	AIR	3.7934	5014.4	21.74	21.76	612.150	781.184	375.336	178.038	-0.303	-0.005	0.32	0	296.75	
19900523	71286	420	AIR	3.7934	5014.4	21.82	21.76	612.138	781.184	375.311	178.038	-0.303	-0.005	0.32	0	296.68	
19900524	7366	421	N2	3.7934	5014.4	21.69	21.77	594.502	777.508	375.324	178.000	-0.303	-0.005	0.00	0	276.64	
19900524	7366	421	N2	3.7934	5014.4	21.79	21.77	594.558	777.508	375.328	178.000	-0.303	-0.005	0.00	0	276.60	
19900524	7366	422	N2	3.7934	5014.4	21.71	21.73	595.106	778.988	375.329	177.974	-0.303	-0.005	0.00	0	276.64	
19900524	7366	422	N2	3.7934	5014.4	21.74	21.73	595.078	778.988	375.310	177.974	-0.303	-0.005	0.00	0	276.60	
19900611	71370	423	AIR	3.7934	5014.4	22.34	22.03	700.414	782.645	375.367	178.145	-0.303	-0.005	0.31	0	406.43	
19900611	71370	423	AIR	3.7934	5014.4	22.41	22.03	700.595	782.645	375.366	178.145	-0.303	-0.005	0.31	0	406.56	
19900612	71370	424	AIR	3.7934	5014.4	21.94	22.35	700.080	783.315	375.398	178.008	-0.303	-0.005	0.31	0	406.48	
19900612	71370	424	AIR	3.7934	5014.4	22.00	22.35	700.134	783.315	375.364	178.008	-0.303	-0.005	0.31	0	406.50	
19900612	35299	425	N2	3.7934	5014.4	21.85	21.96	706.772	783.148	375.350	178.082	-0.303	-0.005	0.00	0	415.02	
19900612	35299	425	N2	3.7934	5014.4	21.94	21.96	706.870	783.148	375.339	178.082	-0.303	-0.005	0.00	0	415.03	
19900613	35299	426	N2	3.7934	5014.4	22.23	21.89	706.754	781.970	375.345	178.012	-0.303	-0.005	0.00	0	415.10	
19900613	35299	426	N2	3.7934	5014.4	22.25	21.89	706.726	781.970	375.337	178.012	-0.303	-0.005	0.00	0	415.04	
19900614	39239	427	N2	3.7934	5014.4	21.51	22.24	640.111	782.125	375.368	178.043	-0.303	-0.005	0.00	0	332.57	
19900614	39239	427	N2	3.7934	5014.4	21.60	22.24	640.262	782.125	375.298	178.043	-0.303	-0.005	0.00	0	332.74	
19900615	34819	428	AIR	3.7934	5014.4	21.69	21.54	577.724	784.616	375.352	178.040	-0.303	-0.005	0.24	0	251.92	
19900615	34819	428	AIR	3.7934	5014.4	21.74	21.54	577.835	784.616	375.341	178.040	-0.303	-0.005	0.24	0	252.03	
19900620	34819	429	AIR	3.7934	5014.4	22.07	21.88	577.618	783.985	375.348	178.030	-0.303	-0.005	0.24	0	252.01	
19900620	34819	429	AIR	3.7934	5014.4	22.14	21.88	577.676	783.985	375.355	178.030	-0.303	-0.005	0.24	0	252.01	
19900702	3753	430	N2	3.7934	5014.4	22.66	22.01	572.887	783.231	375.348	178.116	-0.303	-0.005	0.00	0	246.30	HG CONTACTED POINTER PREMATURELY
19900702	3753	430	N2	3.7934	5014.4	22.93	22.01	573.058	783.231	375.356	178.116	-0.303	-0.005	0.00	0	246.26	
19900703	3753	431	N2	3.7934	5014.4	21.92	22.71	571.595	782.221	375.360	178.040	-0.303	-0.005	0.00	0	246.31	
19900703	3753	431	N2	3.7934	5014.4	21.97	22.71	571.604	782.221	375.364	178.040	-0.303	-0.005	0.00	0	246.27	
19900703	71479	432	AIR	3.7934	5014.4	22.64	22.34	737.860	782.671	375.332	178.029	-0.303	-0.005	0.30	0	453.41	
19900703	71479	432	AIR	3.7934	5014.4	22.73	22.34	737.942	782.671	375.350	178.029	-0.303	-0.005	0.30	0	453.34	
19900705	71479	433	AIR	3.7934	5014.4	22.03	21.48	737.929	782.195	375.314	178.000	-0.303	-0.005	0.30	0	453.45	
19900705	71479	433	AIR	3.7934	5014.4	22.17	21.48	738.108	782.195	375.294	178.000	-0.303	-0.005	0.30	0	453.47	
19900706	35316	434	N2	3.7934	5014.4	21.92	22.10	752.288	782.360	375.338	177.964	-0.303	-0.005	0.00	0	472.88	
19900706	35316	434	N2	3.7934	5014.4	22.04	22.10	752.438	782.360	375.338	177.964	-0.303	-0.005	0.00	0	472.86	
19900709	35316	435	N2	3.7934	5014.4	21.94	21.46	753.748	783.599	375.333	178.104	-0.303	-0.005	0.00	0	472.74	
19900709	35316	435	N2	3.7934	5014.4	22.11	21.46	753.970	783.599	375.298	178.104	-0.303	-0.005	0.00	0	472.77	
19900710	71251	436	AIR	3.7934	5014.4	21.83	22.00	546.468	784.136	375.343	177.990	-0.303	-0.005	0.34	0	213.17	
19900710	71251	436	AIR	3.7934	5014.4	22.18	22.00	546.709	784.136	375.352	177.990	-0.303	-0.005	0.34	0	213.20	
19900710	71251	437	AIR	3.7934	5014.4	22.51	21.88	546.195	781.454	375.320	178.029	-0.303	-0.005	0.34	0	213.21	
19900710	71251	437	AIR	3.7934	5014.4	22.75	21.88	546.338	781.454	375.327	178.029	-0.303	-0.005	0.34	0	213.20	
19900711	2408	438	N2	3.7934	5014.4	22.13	22.61	532.377	781.724	375.338	178.016	-0.303	-0.005	0.00	0	196.92	
19900711	2408	438	N2	3.7934	5014.4	22.36	22.61	532.491	781.724	375.324	178.016	-0.303	-0.005	0.00	0	196.92	HG CONTACTED POINTER PREMATURELY
19900712	2408	439	N2	3.7934	5014.4	22.62	22.20	531.968	778.124	375.358	178.016	-0.303	-0.005	0.00	0	196.92	
19900712	2408	439	N2	3.7934	5014.4	22.72	22.20	531.972	778.124	375.310	178.016	-0.303	-0.005	0.00	0	196.92	
19900712	67615	440	AIR	3.7934	5014.4	22.53	22.66	775.870	780.502	375.328	177.972	-0.303	-0.005	0.30	0	503.69	HG CONTACTED POINTER PREMATURELY
19900712	67615	440	AIR	3.7934	5014.4	22.68	22.66	776.144	780.502	375.277	177.972	-0.303	-0.005	0.30	0	503.82	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 18/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19900712	67615	441	AIR	3.7934	5014.4	22.86	22.58	777.594	782.314	375.340	178.012	-0.303	-0.005	0.30	0	503.62	
19900712	67615	441	AIR	3.7934	5014.4	23.05	22.58	777.942	782.314	375.279	178.012	-0.303	-0.005	0.30	0	503.79	
19900713	39239	442	N2	3.7934	5014.4	22.60	22.94	640.012	780.538	375.300	177.934	-0.303	-0.005	0.00	0	332.88	
19900713	39239	442	N2	3.7934	5014.4	22.74	22.94	640.172	780.538	375.317	177.934	-0.303	-0.005	0.00	0	332.89	
19900821	66556	443	AIR	3.7934	5014.4	22.63	22.16	457.461	787.620	375.312	177.974	-0.303	-0.005	0.37	0	101.05	HG CONTACTED POINTER PREMATURELY
19900821	66556	443	AIR	3.7934	5014.4	22.70	22.16	457.454	787.620	375.282	177.974	-0.303	-0.005	0.37	0	101.05	HG CONTACTED POINTER PREMATURELY
19900821	66556	444	AIR	3.7934	5014.4	22.73	22.66	457.170	786.898	375.282	178.051	-0.303	-0.005	0.37	0	101.00	
19900821	66556	444	AIR	3.7934	5014.4	22.88	22.66	457.187	786.898	375.260	178.051	-0.303	-0.005	0.37	0	101.00	HG CONTACTED POINTER PREMATURELY
19900822	62807	445	AIR	3.7934	5014.4	22.51	22.78	651.074	794.083	375.276	178.041	-0.303	-0.005	0.29	10	338.89	TEMP UNCERTAINTY-ALL FANS OFF IN CABINET
19900822	62807	445	AIR	3.7934	5014.4	22.53	22.78	650.941	794.083	375.264	178.041	-0.303	-0.005	0.29	0	338.71	HG CONTACTED POINTER PREMATURELY
19900822	62807	445	AIR	3.7934	5014.4	22.62	22.78	651.032	794.083	375.204	178.041	-0.303	-0.005	0.29	0	338.79	
19900823	62807	446	AIR	3.7934	5014.4	22.46	22.58	646.918	784.641	375.266	177.962	-0.303	-0.005	0.29	0	338.75	
19900823	62807	446	AIR	3.7934	5014.4	22.62	22.58	647.149	784.641	375.263	177.962	-0.303	-0.005	0.29	0	338.85	
19900823	62817	447	AIR	3.7934	5014.4	22.51	22.51	668.453	784.499	375.258	177.947	-0.303	-0.005	0.28	0	365.65	HG CONTACTED POINTER PREMATURELY
19900823	62817	447	AIR	3.7934	5014.4	22.63	22.51	668.520	784.499	375.260	177.947	-0.303	-0.005	0.28	0	365.57	HG CONTACTED POINTER PREMATURELY
19900823	62817	447	AIR	3.7934	5014.4	22.69	22.51	668.514	784.499	375.228	177.947	-0.303	-0.005	0.28	0	365.53	
19900824	62817	448	AIR	3.7934	5014.4	22.69	22.56	668.244	783.950	375.220	178.024	-0.303	-0.005	0.28	0	365.64	
19900824	62817	448	AIR	3.7934	5014.4	22.81	22.56	668.328	783.950	375.210	178.024	-0.303	-0.005	0.28	0	365.60	
19900824	34891	449	AIR	3.7934	5014.4	22.80	22.74	613.540	781.675	375.242	177.968	-0.303	-0.005	0.24	0	298.33	HG CONTACTED POINTER PREMATURELY
19900824	34891	449	AIR	3.7934	5014.4	23.06	22.74	613.741	781.675	375.250	177.968	-0.303	-0.005	0.24	0	298.29	HG CONTACTED POINTER PREMATURELY
19900824	34891	449	AIR	3.7934	5014.4	23.10	22.74	613.686	781.675	375.226	177.968	-0.303	-0.005	0.24	0	298.21	
19900828	34891	450	AIR	3.7934	5014.4	22.89	22.59	615.448	786.155	375.250	177.956	-0.303	-0.005	0.24	0	298.24	
19900828	34891	450	AIR	3.7934	5014.4	22.95	22.59	615.512	786.155	375.247	177.956	-0.303	-0.005	0.24	0	298.25	
19900828	62814	451	AIR	3.7934	5014.4	22.58	22.90	714.716	783.526	375.244	177.968	-0.303	-0.005	0.31	0	424.75	
19900828	62814	451	AIR	3.7934	5014.4	22.69	22.90	714.838	783.526	375.220	177.968	-0.303	-0.005	0.31	0	424.76	
19900829	62814	452	AIR	3.7934	5014.4	23.00	22.62	716.524	785.051	375.256	177.910	-0.303	-0.005	0.31	0	424.82	
19900829	62814	452	AIR	3.7934	5014.4	23.05	22.62	716.588	785.051	375.232	177.910	-0.303	-0.005	0.31	0	424.86	
19900829	39239	453	N2	3.7934	5014.4	22.86	23.02	642.227	785.424	375.252	177.948	-0.303	-0.005	0.00	0	332.83	
19900829	39239	453	N2	3.7934	5014.4	22.94	23.02	642.272	785.424	375.229	177.948	-0.303	-0.005	0.00	0	332.82	
19920219	1607	454	AIR	3.7934	5014.42	20.87	20.78	815.577	597.438	375.070	177.704	-0.303	-0.005	0.30	0	795.11	
19920219	1607	454	AIR	3.7934	5014.42	20.94	20.78	815.633	597.438	375.092	177.704	-0.303	-0.005	0.30	0	794.97	
19920220	1641	455	AIR	3.7934	5014.42	20.92	20.89	845.728	392.796	375.080	177.798	-0.303	-0.005	0.30	0	1659.77	
19920220	1641	455	AIR	3.7934	5014.42	21.01	20.89	845.828	392.796	375.106	177.798	-0.303	-0.005	0.30	0	1659.49	
19920305	73292	456	N2	3.7934	5014.42	20.74	20.78	641.176	787.569	375.175	177.806	-0.303	-0.005	0.00	0	330.23	HG CONTACTED POINTER PREMATURELY
19920305	73292	456	N2	3.7934	5014.42	20.82	20.78	641.374	787.569	375.154	177.806	-0.303	-0.005	0.00	0	330.41	
19920306	73292	457	N2	3.7934	5014.42	20.75	20.75	642.891	790.888	375.181	177.790	-0.303	-0.005	0.00	0	330.50	
19920306	73292	457	N2	3.7934	5014.42	20.92	20.75	643.056	790.888	375.185	177.790	-0.303	-0.005	0.00	0	330.50	
19920312	39354	458	N2	3.7934	5014.42	21.78	20.34	665.106	787.530	375.160	177.776	-0.303	-0.005	0.00	0	358.15	
19920312	39354	458	N2	3.7934	5014.42	21.99	20.34	665.312	787.530	375.146	177.776	-0.303	-0.005	0.00	0	358.15	
19920313	39354	459	N2	3.7934	5014.42	20.93	21.87	665.994	794.562	375.185	177.798	-0.303	-0.005	0.00	0	358.18	
19920313	39354	459	N2	3.7934	5014.42	21.23	21.87	666.194	794.562	375.068	177.798	-0.303	-0.005	0.00	0	358.18	
19920330	6052	460	N2	3.7934	5014.42	20.55	20.34	669.304	791.426	375.138	177.794	-0.303	-0.005	0.00	0	362.68	
19920331	6052	460	N2	3.7934	5014.42	20.87	20.34	669.808	791.426	375.134	177.794	-0.303	-0.005	0.00	0	362.89	
19920331	6052	461	N2	3.7934	5014.42	20.64	20.63	668.160	789.049	375.163	177.790	-0.303	-0.005	0.00	0	362.90	
19920331	6052	461	N2	3.7934	5014.42	20.71	20.63	668.188	789.049	375.162	177.790	-0.303	-0.005	0.00	0	362.84	
19920421	1607	462	AIR	3.7934	5014.42	20.78	20.27	797.088	579.217	375.178	177.915	-0.303	-0.005	0.30	0	795.20	
19920421	1607	462	AIR	3.7934	5014.42	20.84	20.27	797.178	579.217	375.136	177.915	-0.303	-0.005	0.30	0	795.28	
19920421	75593	463	N2	3.7934	5014.42	20.93	20.80	641.976	787.240	375.156	177.832	-0.303	-0.005	0.00	0	331.24	
19920421	75593	463	N2	3.7934	5014.42	20.98	20.80	642.116	787.240	375.162	177.832	-0.303	-0.005	0.00	0	331.35	
19920421	75593	464	N2	3.7934	5014.42	21.05	20.95	639.692	781.793	375.140	177.840	-0.303	-0.005	0.00	0	331.42	
19920421	75593	464	N2	3.7934	5014.42	21.09	20.95	639.744	781.793	375.156	177.840	-0.303	-0.005	0.00	0	331.42	
19920514	1641	465	AIR	3.7934	5014.42	20.93	21.22	794.834	389.579	375.182	177.896	-0.303	-0.005	0.30	0	1504.15	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 19/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19920914	1641	465	AIR	3.7934	5014.42	20.99	21.22	794.947	389.579	375.125	177.896	-0.303	-0.005	0.30	0	1504.44	
19920514	181	466	N2	3.7934	5014.42	21.00	20.95	640.068	778.632	375.162	177.855	-0.303	-0.005	0.00	0	333.68	
19920514	181	466	N2	3.7934	5014.42	21.07	20.95	640.209	778.632	375.115	177.855	-0.303	-0.005	0.00	0	333.83	
19920514	181	467	N2	3.7934	5014.42	21.11	21.02	641.188	780.888	375.154	177.910	-0.303	-0.005	0.00	0	333.83	
19920514	181	467	N2	3.7934	5014.42	21.17	21.02	641.261	780.888	375.166	177.910	-0.303	-0.005	0.00	0	333.84	
19920604	1641	468	AIR	3.7934	5014.42	21.21	21.20	803.500	393.779	375.146	177.962	-0.303	-0.005	0.30	0	1504.41	
19920604	1641	468	AIR	3.7934	5014.42	21.31	21.20	803.772	393.779	375.118	177.962	-0.303	-0.005	0.30	0	1504.92	
19921216	6052	469	N2	3.7934	5014.43	21.12	20.91	670.560	793.528	375.074	177.748	-0.303	-0.005	0.00	0	363.04	
19921216	6052	469	N2	3.7934	5014.43	21.21	20.91	670.780	793.528	375.064	177.748	-0.303	-0.005	0.00	0	363.20	
19921217	6052	470	N2	3.7934	5014.43	20.70	21.16	669.917	793.467	375.091	177.802	-0.303	-0.005	0.00	0	363.17	
19921217	6052	470	N2	3.7934	5014.43	21.30	21.16	670.564	793.467	375.098	177.802	-0.303	-0.005	0.00	0	363.17	
19930120	39361	471	N2	3.7934	5014.43	21.29	21.39	672.274	797.250	375.161	177.884	-0.303	-0.005	0.00	0	363.33	
19930120	39361	471	N2	3.7934	5014.43	21.43	21.39	672.458	797.250	375.134	177.884	-0.303	-0.005	0.00	0	363.41	
19930120	39361	472	N2	3.7934	5014.43	21.45	21.33	671.037	794.226	375.156	177.944	-0.303	-0.005	0.00	0	363.34	HG CONTACTED POINTER PREMATURELY
19930120	39361	472	N2	3.7934	5014.43	21.58	21.33	671.253	794.226	375.148	177.944	-0.303	-0.005	0.00	0	363.45	
19930210	181	473	N2	3.7934	5014.43	21.44	21.52	645.188	790.054	375.186	177.798	-0.303	-0.005	0.00	0	333.89	
19930210	181	473	N2	3.7934	5014.43	21.54	21.52	645.329	790.054	375.140	177.798	-0.303	-0.005	0.00	0	334.00	HG CONTACTED POINTER PREMATURELY
19930210	181	474	N2	3.7934	5014.43	21.36	21.46	648.194	796.967	375.151	177.876	-0.303	-0.005	0.00	0	333.96	
19930210	181	474	N2	3.7934	5014.43	21.45	21.46	648.251	796.967	375.146	177.876	-0.303	-0.005	0.00	0	333.93	
19930223	39239	475	N2	3.7934	5014.43	21.23	21.25	646.502	794.847	375.142	177.940	-0.303	-0.005	0.00	0	332.97	
19930223	39239	475	N2	3.7934	5014.43	21.33	21.25	646.578	794.847	375.121	177.940	-0.303	-0.005	0.00	0	332.97	
19930223	39239	476	N2	3.7934	5014.43	21.39	21.28	644.764	790.686	375.156	177.978	-0.303	-0.005	0.00	0	332.93	
19930223	39239	476	N2	3.7934	5014.43	21.58	21.28	644.924	790.686	375.142	177.978	-0.303	-0.005	0.00	0	332.92	
19930224	39272	477	N2	3.7934	5014.43	21.16	21.43	667.280	791.700	375.158	177.810	-0.303	-0.005	0.00	0	360.62	
19930224	39272	477	N2	3.7934	5014.43	21.28	21.43	667.527	791.700	375.127	177.810	-0.303	-0.005	0.00	0	360.81	
19930224	39272	478	N2	3.7934	5014.43	21.24	21.20	666.729	790.040	375.152	177.928	-0.303	-0.005	0.00	0	360.59	HG CONTACTED POINTER PREMATURELY
19930224	39272	478	N2	3.7934	5014.43	21.28	21.20	666.918	790.040	375.146	177.928	-0.303	-0.005	0.00	0	360.78	
19930324	11092	479	N2	3.7934	5014.43	21.36	21.31	642.931	793.676	375.212	177.832	-0.303	-0.005	0.00	0	328.98	
19930324	11092	479	N2	3.7934	5014.43	21.42	21.31	643.043	793.676	375.166	177.832	-0.303	-0.005	0.00	0	329.10	
19930325	11092	480	N2	3.7934	5014.43	21.45	21.38	642.243	791.943	375.192	177.924	-0.303	-0.005	0.00	0	329.11	
19930325	11092	480	N2	3.7934	5014.43	21.48	21.38	642.342	791.943	375.222	177.924	-0.303	-0.005	0.00	0	329.16	HG CONTACTED POINTER PREMATURELY
19930426	66638	481	AIR	3.7934	5014.43	21.54	21.49	648.674	788.893	375.176	177.978	-0.303	-0.005	0.31	0	338.47	
19930426	66638	481	AIR	3.7934	5014.43	21.57	21.49	648.790	788.893	375.159	177.978	-0.303	-0.005	0.31	0	338.60	
19930427	66638	482	AIR	3.7934	5014.43	21.68	21.55	649.576	790.475	375.184	177.957	-0.303	-0.005	0.31	0	338.59	
19930427	66638	482	AIR	3.7934	5014.43	21.71	21.55	649.541	790.475	375.151	177.957	-0.303	-0.005	0.31	0	338.55	
19930427	66696	483	AIR	3.7934	5014.43	21.46	21.70	665.538	788.103	375.190	177.948	-0.303	-0.005	0.31	0	360.23	HG CONTACTED POINTER PREMATURELY
19930427	66696	483	AIR	3.7934	5014.43	21.49	21.70	665.630	788.103	375.160	177.948	-0.303	-0.005	0.31	0	360.34	
19930427	66696	484	AIR	3.7934	5014.43	21.41	21.46	666.248	788.943	375.196	177.879	-0.303	-0.005	0.31	0	360.32	
19930427	66696	484	AIR	3.7934	5014.43	21.45	21.46	666.276	788.943	375.202	177.879	-0.303	-0.005	0.31	0	360.30	HG CONTACTED POINTER PREMATURELY
19930506	71479	485	AIR	3.7934	5014.43	21.25	21.52	742.139	791.136	375.202	177.859	-0.303	-0.005	0.30	0	453.41	
19930506	71479	485	AIR	3.7934	5014.43	21.41	21.52	742.494	791.136	375.180	177.859	-0.303	-0.005	0.30	0	453.62	
19930506	71479	486	AIR	3.7934	5014.43	21.35	21.29	743.316	792.297	375.210	177.916	-0.303	-0.005	0.30	0	453.50	
19930506	71479	486	AIR	3.7934	5014.43	21.47	21.29	743.540	792.297	375.191	177.916	-0.303	-0.005	0.30	0	453.61	
19930514	71251	487	AIR	3.7934	5014.43	21.00	21.16	548.208	790.927	375.226	177.998	-0.303	-0.005	0.34	0	213.10	
19930514	71251	487	AIR	3.7934	5014.43	21.08	21.16	548.210	790.927	375.188	177.998	-0.303	-0.005	0.34	0	213.09	HG CONTACTED POINTER PREMATURELY
19930514	71251	488	AIR	3.7934	5014.43	21.12	21.02	548.130	789.869	375.164	177.928	-0.303	-0.005	0.34	0	213.23	
19930514	71251	488	AIR	3.7934	5014.43	21.27	21.02	548.262	789.869	375.179	177.928	-0.303	-0.005	0.34	0	213.26	
19930514	4274	489	N2	3.7934	5014.43	21.41	21.17	572.556	790.763	375.181	177.920	-0.303	-0.005	0.00	0	243.34	
19930514	4274	489	N2	3.7934	5014.43	21.47	21.17	572.583	790.763	375.178	177.920	-0.303	-0.005	0.00	0	243.33	
19930520	4274	490	N2	3.7934	5014.43	21.91	21.47	571.286	786.781	375.220	178.050	-0.303	-0.005	0.00	0	243.18	
19930520	4274	490	N2	3.7934	5014.43	21.91	21.47	571.303	786.781	375.194	178.050	-0.303	-0.005	0.00	0	243.24	
19930520	6071	491	N2	3.7934	5014.43	21.65	21.91	625.090	788.049	375.230	177.910	-0.303	-0.005	0.00	0	310.18	
19930520	6071	491	N2	3.7934	5014.43	21.72	21.91	625.044	788.049	375.182	177.910	-0.303	-0.005	0.00	0	310.11	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 20/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19930521	6071	492	N2	3.7934	5014.43	21.35	21.67	625.040	788.049	375.214	177.972	-0.303	-0.005	0.00	0	310.24	
19930521	6071	492	N2	3.7934	5014.43	21.50	21.67	625.196	788.049	375.196	177.972	-0.303	-0.005	0.00	0	310.29	
19930526	4296	493	N2	3.7934	5014.43	21.44	21.42	634.253	789.759	375.185	177.937	-0.303	-0.005	0.00	0	320.44	
19930526	4296	493	N2	3.7934	5014.43	21.53	21.42	634.416	789.759	375.178	177.937	-0.303	-0.005	0.00	0	320.55	
19930526	4296	494	N2	3.7934	5014.43	21.63	21.48	635.604	792.444	375.208	177.916	-0.303	-0.005	0.00	0	320.52	
19930526	4296	494	N2	3.7934	5014.43	21.68	21.48	635.665	792.444	375.172	177.916	-0.303	-0.005	0.00	0	320.58	
19930527	39256	495	N2	3.7934	5014.43	21.57	21.66	654.869	790.302	375.199	177.936	-0.303	-0.005	0.00	0	345.83	
19930527	39256	495	N2	3.7934	5014.43	21.69	21.66	654.958	790.302	375.162	177.936	-0.303	-0.005	0.00	0	345.84	
19930527	39256	496	N2	3.7934	5014.43	21.61	21.60	655.504	791.526	375.188	177.930	-0.303	-0.005	0.00	0	345.82	
19930527	39256	496	N2	3.7934	5014.43	21.66	21.60	655.556	791.526	375.182	177.930	-0.303	-0.005	0.00	0	345.82	
19930602	66625	497	AIR	3.7934	5014.43	21.79	21.54	655.927	793.476	375.220	177.954	-0.303	-0.005	0.29	0	344.59	
19930602	66625	497	AIR	3.7934	5014.43	21.86	21.54	656.074	793.476	375.160	177.954	-0.303	-0.005	0.29	0	344.76	
19930603	66625	498	AIR	3.7934	5014.43	21.31	21.82	654.377	790.903	375.222	177.925	-0.303	-0.005	0.29	11	345.04	
19930603	66625	498	AIR	3.7934	5014.43	21.44	21.82	654.502	790.903	375.148	177.925	-0.303	-0.005	0.29	11	345.13	
19930604	39239	499	N2	3.7934	5014.43	21.41	21.36	644.678	790.540	375.211	177.924	-0.303	-0.005	0.00	0	332.88	
19930604	39239	499	N2	3.7934	5014.43	21.56	21.36	644.780	790.540	375.182	177.924	-0.303	-0.005	0.00	0	332.86	
19930604	71341	500	AIR	3.7934	5014.43	21.60	21.49	635.518	788.540	375.214	177.956	-0.303	-0.005	0.31	0	322.18	
19930604	71341	500	AIR	3.7934	5014.43	21.71	21.49	635.610	788.540	375.190	177.956	-0.303	-0.005	0.31	0	322.20	
19930609	71341	501	AIR	3.7934	5014.43	21.67	21.64	635.882	789.795	375.218	177.892	-0.303	-0.005	0.31	0	322.03	
19930609	71341	501	AIR	3.7934	5014.43	21.73	21.64	635.918	789.795	375.157	177.892	-0.303	-0.005	0.31	0	322.08	
19930610	66625	502	AIR	3.7934	5014.43	21.31	21.68	653.701	789.850	375.210	177.914	-0.303	-0.005	0.29	0	344.63	
19930610	66625	502	AIR	3.7934	5014.43	21.44	21.68	653.756	789.850	375.173	177.914	-0.303	-0.005	0.29	0	344.59	
19930610	34819	503	AIR	3.7934	5014.43	21.72	21.35	578.252	785.645	375.214	177.999	-0.303	-0.005	0.24	0	252.10	
19930610	34819	503	AIR	3.7934	5014.43	21.75	21.35	578.282	785.645	375.180	177.999	-0.303	-0.005	0.24	0	252.16	
19930610	34819	504	AIR	3.7934	5014.43	22.32	21.74	579.131	787.901	375.206	177.924	-0.303	-0.005	0.24	0	252.05	
19930610	34819	504	AIR	3.7934	5014.43	22.36	21.74	579.211	787.901	375.180	177.924	-0.303	-0.005	0.24	0	252.15	
19930611	71370	505	AIR	3.7934	5014.43	21.61	22.34	702.030	787.837	375.198	177.862	-0.303	-0.005	0.31	0	406.51	
19930611	71370	505	AIR	3.7934	5014.43	21.68	22.34	702.140	787.837	375.202	177.862	-0.303	-0.005	0.31	0	406.54	
19930611	71370	506	AIR	3.7934	5014.43	22.08	21.64	702.905	786.936	375.190	177.915	-0.303	-0.005	0.31	0	406.54	
19930611	71370	506	AIR	3.7934	5014.43	22.10	21.64	703.018	786.936	375.202	177.915	-0.303	-0.005	0.31	0	406.64	
19930616	35299	507	N2	3.7934	5014.43	21.48	21.26	713.219	794.512	375.210	177.920	-0.303	-0.005	0.00	10	414.89	HG CONTACTED POINTER PREMATURELY
19930616	35299	507	N2	3.7934	5014.43	21.53	21.26	713.602	794.512	375.176	177.920	-0.303	-0.005	0.00	0	415.33	
19930616	35299	508	N2	3.7934	5014.43	21.75	21.50	708.764	786.044	375.194	177.952	-0.303	-0.005	0.00	0	415.10	
19930616	35299	508	N2	3.7934	5014.43	21.75	21.50	708.830	786.044	375.182	177.952	-0.303	-0.005	0.00	0	415.20	
19930617	3753	509	N2	3.7934	5014.43	21.28	21.75	573.784	788.302	375.207	177.950	-0.303	-0.005	0.00	0	246.46	
19930617	3753	509	N2	3.7934	5014.43	21.44	21.75	573.900	788.302	375.218	177.950	-0.303	-0.005	0.00	0	246.44	
19930617	3753	510	N2	3.7934	5014.43	21.50	21.32	572.748	783.648	375.207	177.981	-0.303	-0.005	0.00	0	246.49	
19930617	3753	510	N2	3.7934	5014.43	21.54	21.32	572.768	783.648	375.176	177.981	-0.303	-0.005	0.00	0	246.52	
19930617	6078	511	N2	3.7934	5014.43	21.87	21.53	625.993	787.461	375.194	177.986	-0.303	-0.005	0.00	0	311.02	
19930617	6078	511	N2	3.7934	5014.43	22.13	21.53	626.231	787.461	375.194	177.986	-0.303	-0.005	0.00	0	311.03	
19930623	6078	512	N2	3.7934	5014.43	22.38	22.03	625.318	786.010	375.222	177.936	-0.303	-0.005	0.00	0	310.85	
19930623	6078	512	N2	3.7934	5014.43	22.41	22.03	625.376	786.010	375.167	177.936	-0.303	-0.005	0.00	0	310.96	
19930624	2399	513	N2	3.7934	5014.43	22.21	22.39	635.630	786.490	375.205	177.926	-0.303	-0.005	0.00	0	324.08	
19930624	2399	513	N2	3.7934	5014.43	22.20	22.39	635.624	786.490	375.218	177.926	-0.303	-0.005	0.00	0	324.07	
19930624	2399	514	N2	3.7934	5014.43	22.77	22.22	636.578	787.332	375.234	177.929	-0.303	-0.005	0.00	0	323.93	
19930624	2399	514	N2	3.7934	5014.43	22.74	22.22	636.699	787.332	375.228	177.929	-0.303	-0.005	0.00	0	324.12	
19930625	35316	515	N2	3.7934	5014.43	21.56	22.77	754.906	788.824	375.227	177.944	-0.303	-0.005	0.00	0	472.99	
19930625	35316	515	N2	3.7934	5014.43	21.73	22.77	755.162	788.824	375.200	177.944	-0.303	-0.005	0.00	0	473.06	
19930630	35316	516	N2	3.7934	5014.43	21.65	21.84	756.004	788.708	375.202	177.942	-0.303	-0.005	0.00	0	472.76	HG CONTACTED POINTER PREMATURELY
19930630	35316	516	N2	3.7934	5014.43	21.67	21.84	756.168	788.708	375.185	177.942	-0.303	-0.005	0.00	0	472.95	
19930701	67615	517	AIR	3.7934	5014.43	21.48	21.66	780.146	786.924	375.214	177.947	-0.303	-0.005	0.30	0	503.93	
19930701	67615	517	AIR	3.7934	5014.43	21.54	21.66	780.286	786.924	375.188	177.947	-0.303	-0.005	0.30	0	504.03	
19930701	67615	518	AIR	3.7934	5014.43	21.56	21.50	780.264	786.579	375.210	177.910	-0.303	-0.005	0.30	0	503.91	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 21/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19930701	67615	518	AIR	3.7934	5014.43	21.60	21.50	780.498	786.579	375.182	177.910	-0.303	-0.005	0.30	0	504.16	
19930702	71286	519	AIR	3.7934	5014.43	21.46	21.58	614.836	788.201	375.235	177.909	-0.303	-0.005	0.32	0	296.84	
19930702	71286	519	AIR	3.7934	5014.43	21.54	21.58	614.802	788.201	375.194	177.909	-0.303	-0.005	0.32	0	296.76	
19930702	71286	520	AIR	3.7934	5014.43	21.58	21.49	613.694	785.083	375.196	177.907	-0.303	-0.005	0.32	0	296.76	
19930702	71286	520	AIR	3.7934	5014.43	21.63	21.49	613.740	785.083	375.186	177.907	-0.303	-0.005	0.32	0	296.78	
19930707	71308	521	AIR	3.7934	5014.43	21.68	21.48	679.576	789.409	375.176	177.912	-0.303	-0.005	0.32	0	376.30	
19930707	71308	521	AIR	3.7934	5014.43	21.71	21.48	679.682	789.409	375.166	177.912	-0.303	-0.005	0.32	0	376.40	
19930707	71308	522	AIR	3.7934	5014.43	21.96	21.69	679.187	788.388	375.175	177.934	-0.303	-0.005	0.32	0	376.36	
19930707	71308	522	AIR	3.7934	5014.43	22.03	21.69	679.217	788.388	375.158	177.934	-0.303	-0.005	0.32	0	376.32	
19930708	1540	523	N2	3.7934	5014.43	21.96	21.99	680.857	786.132	375.180	177.942	-0.303	-0.005	0.00	0	380.61	
19930708	1540	523	N2	3.7934	5014.43	21.96	21.99	680.985	786.132	375.158	177.942	-0.303	-0.005	0.00	0	380.80	
19930708	1540	524	N2	3.7934	5014.43	21.97	21.96	682.697	789.503	375.180	177.925	-0.303	-0.005	0.00	0	380.73	
19930708	1540	524	N2	3.7934	5014.43	21.99	21.96	682.725	789.503	375.186	177.925	-0.303	-0.005	0.00	0	380.73	
19930713	2408	525	N2	3.7934	5014.43	21.66	21.81	535.039	792.069	375.201	177.910	-0.303	-0.005	0.00	0	196.79	
19930713	2408	525	N2	3.7934	5014.43	21.68	21.81	535.076	792.069	375.190	177.910	-0.303	-0.005	0.00	0	196.84	HG CONTACTED POINTER PREMATURELY
19930714	2408	526	N2	3.7934	5014.43	21.35	21.66	534.722	790.839	375.216	177.942	-0.303	-0.005	0.00	0	196.90	
19930714	2408	526	N2	3.7934	5014.43	21.41	21.66	534.806	790.839	375.174	177.942	-0.303	-0.005	0.00	0	197.02	
19930714	7366	527	N2	3.7934	5014.43	21.49	21.37	598.527	788.306	375.170	177.923	-0.303	-0.005	0.00	0	276.70	
19930714	7366	527	N2	3.7934	5014.43	21.56	21.37	598.658	788.306	375.169	177.923	-0.303	-0.005	0.00	0	276.80	
19930714	7366	528	N2	3.7934	5014.43	21.71	21.52	599.548	791.110	375.174	177.906	-0.303	-0.005	0.00	0	276.62	
19930714	7366	528	N2	3.7934	5014.43	21.76	21.52	599.650	791.110	375.140	177.906	-0.303	-0.005	0.00	0	276.74	
19930715	39361	529	N2	3.7934	5014.43	21.52	21.74	669.518	791.899	375.200	177.842	-0.303	-0.005	0.00	10	363.17	
19930715	39361	529	N2	3.7934	5014.43	21.63	21.74	669.841	791.899	375.162	177.842	-0.303	-0.005	0.00	0	363.47	
19930715	39361	530	N2	3.7934	5014.43	21.86	21.56	670.372	792.128	375.160	177.904	-0.303	-0.005	0.00	0	363.50	
19930715	39361	530	N2	3.7934	5014.43	21.93	21.56	670.438	792.128	375.154	177.904	-0.303	-0.005	0.00	0	363.50	
19930907	11092	531	N2	3.7934	5014.44	22.18	21.31	641.838	789.300	375.210	177.902	-0.303	-0.005	0.00	0	329.05	
19930907	11092	531	N2	3.7934	5014.44	22.15	21.31	641.958	789.300	375.198	177.902	-0.303	-0.005	0.00	0	329.24	
19930908	11092	532	N2	3.7934	5014.44	22.07	22.18	641.498	790.655	375.222	177.989	-0.303	-0.005	0.00	0	329.08	
19930908	11092	532	N2	3.7934	5014.44	22.06	22.18	641.530	790.655	375.209	177.989	-0.303	-0.005	0.00	0	329.15	
19930909	11081	533	N2	3.7934	5014.44	21.63	22.08	664.027	790.703	375.208	177.938	-0.303	-0.005	0.00	0	357.41	
19930909	11081	533	N2	3.7934	5014.44	21.62	22.08	664.030	790.703	375.180	177.938	-0.303	-0.005	0.00	0	357.46	
19930909	11081	534	N2	3.7934	5014.44	22.10	21.63	662.945	786.522	375.216	177.952	-0.303	-0.005	0.00	0	357.33	HG CONTACTED POINTER PREMATURELY
19930909	11081	534	N2	3.7934	5014.44	22.09	21.63	663.053	786.522	375.178	177.952	-0.303	-0.005	0.00	0	357.52	
19930910	11076	535	N2	3.7934	5014.44	21.42	22.11	645.188	787.984	375.218	177.946	-0.303	-0.005	0.00	0	335.80	
19930910	11076	535	N2	3.7934	5014.44	21.54	22.11	645.292	787.984	375.192	177.946	-0.303	-0.005	0.00	0	335.81	
19930910	11076	536	N2	3.7934	5014.44	21.81	21.44	644.390	783.790	375.210	177.958	-0.303	-0.005	0.00	0	335.86	
19930910	11076	536	N2	3.7934	5014.44	21.91	21.44	644.505	783.790	375.210	177.958	-0.303	-0.005	0.00	0	335.88	
19940725	4286	537	N2	3.7934	5014.45	21.95	22.18	648.434	790.469	375.259	177.867	-0.303	-0.005	0.00	0	337.81	
19940725	4286	537	N2	3.7934	5014.45	22.00	22.18	648.413	790.469	375.171	177.867	-0.303	-0.005	0.00	0	337.84	
19940726	4286	538	N2	3.7934	5014.45	21.83	21.97	647.059	787.829	375.188	177.842	-0.303	-0.005	0.00	11	337.53	CO2 LOSS DURING EXTRACTION-TRANSFERS
19940726	4286	538	N2	3.7934	5014.45	21.87	21.97	647.100	787.829	375.152	177.842	-0.303	-0.005	0.00	11	337.58	CO2 LOSS DURING EXTRACTION-TRANSFERS
19940726	75593	539	N2	3.7934	5014.45	21.90	21.84	667.857	788.725	375.186	177.915	-0.303	-0.005	0.00	0	362.68	
19940726	75593	539	N2	3.7934	5014.45	21.98	21.84	667.915	788.725	375.168	177.915	-0.303	-0.005	0.00	0	362.67	
19940727	75593	540	N2	3.7934	5014.45	22.07	21.93	669.504	791.655	375.214	177.890	-0.303	-0.005	0.00	0	362.84	
19940727	75593	540	N2	3.7934	5014.45	22.08	21.93	669.488	791.655	375.191	177.890	-0.303	-0.005	0.00	0	362.83	
19940802	11076	541	N2	3.7934	5014.45	21.95	22.45	646.390	790.046	375.200	177.914	-0.303	-0.005	0.00	0	335.93	HG CONTACTED POINTER PREMATURELY
19940802	11076	541	N2	3.7934	5014.45	21.96	22.45	646.340	790.046	375.155	177.914	-0.303	-0.005	0.00	0	335.91	
19940802	11076	542	N2	3.7934	5014.45	21.82	21.95	645.002	786.506	375.162	177.910	-0.303	-0.005	0.00	0	335.75	
19940802	11076	542	N2	3.7934	5014.45	21.89	21.95	645.198	786.506	375.158	177.910	-0.303	-0.005	0.00	0	335.92	
19940803	11081	543	N2	3.7934	5014.45	21.89	21.84	661.875	784.795	375.198	177.955	-0.303	-0.005	0.00	0	357.57	HG CONTACTED POINTER PREMATURELY
19940803	11081	543	N2	3.7934	5014.45	21.94	21.84	661.839	784.795	375.182	177.955	-0.303	-0.005	0.00	0	357.48	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 22/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19940803	11081	544	N2	3.7934	5014.45	21.88	21.91	662.238	785.875	375.184	177.912	-0.303	-0.005	0.00	0	357.48	
19940803	11081	544	N2	3.7934	5014.45	21.91	21.91	662.279	785.875	375.152	177.912	-0.303	-0.005	0.00	0	357.54	
19940804	4286	545	N2	3.7934	5014.45	21.90	21.89	645.359	783.138	375.170	177.930	-0.303	-0.005	0.00	0	337.90	
19940804	4286	545	N2	3.7934	5014.45	22.02	21.89	645.433	783.138	375.173	177.930	-0.303	-0.005	0.00	0	337.85	
19940913	1607	546	AIR	3.7934	5014.45	21.77	21.82	804.000	586.842	375.185	177.918	-0.303	-0.005	0.30	0	794.77	
19940913	1607	546	AIR	3.7934	5014.45	21.81	21.82	804.052	586.842	375.150	177.918	-0.303	-0.005	0.30	0	794.81	
19940914	1607	547	AIR	3.7934	5014.45	21.96	21.80	804.426	586.834	375.200	177.967	-0.303	-0.005	0.30	0	795.04	
19940914	1607	547	AIR	3.7934	5014.45	22.04	21.80	804.634	586.834	375.142	177.967	-0.303	-0.005	0.30	0	795.31	
19940914	1641	548	AIR	3.7934	5014.45	22.17	21.98	795.732	389.956	375.176	177.990	-0.303	-0.005	0.30	0	1502.74	
19940914	1641	548	AIR	3.7934	5014.45	22.18	21.98	795.690	389.956	375.142	177.990	-0.303	-0.005	0.30	0	1502.66	
19940915	1641	549	AIR	3.7934	5014.45	22.18	22.18	796.986	390.686	375.194	178.002	-0.303	-0.005	0.30	0	1503.10	
19940915	1641	549	AIR	3.7934	5014.45	22.20	22.18	797.062	390.686	375.185	178.002	-0.303	-0.005	0.30	0	1503.30	
19950322	181	550	N2	3.7934	5014.45	21.38	21.30	645.516	782.800	375.073	177.822	-0.303	-0.005	0.00	10	338.27	HG CONTACTED POINTER PREMATURELY
19950322	181	550	N2	3.7934	5014.45	21.49	21.30	645.914	782.800	375.072	177.822	-0.303	-0.005	0.00	0	338.63	HG CONTACTED POINTER PREMATURELY
19950322	181	551	N2	3.7934	5014.45	21.57	21.42	648.781	789.392	375.068	177.902	-0.303	-0.005	0.00	0	338.64	
19950322	181	551	N2	3.7934	5014.45	21.71	21.42	648.851	789.392	375.035	177.902	-0.303	-0.005	0.00	0	338.59	
19950323	6052	552	N2	3.7934	5014.45	21.62	21.62	668.291	785.844	375.100	177.862	-0.303	-0.005	0.00	10	365.10	HG CONTACTED POINTER PREMATURELY
19950323	6052	552	N2	3.7934	5014.45	21.74	21.62	668.648	785.844	375.065	177.862	-0.303	-0.005	0.00	0	365.43	
19950323	6052	553	N2	3.7934	5014.45	21.89	21.66	668.196	784.636	375.056	177.847	-0.303	-0.005	0.00	0	365.45	
19950323	6052	553	N2	3.7934	5014.45	21.96	21.66	668.332	784.636	375.063	177.847	-0.303	-0.005	0.00	0	365.52	
19950626	6052	554	N2	3.7934	5014.46	21.60	21.52	669.942	788.520	375.097	177.850	-0.303	-0.005	0.00	0	365.45	
19950626	6052	554	N2	3.7934	5014.46	21.80	21.52	670.092	788.520	375.059	177.850	-0.303	-0.005	0.00	0	365.42	
19950627	6052	555	N2	3.7934	5014.46	21.45	21.65	666.403	781.650	375.102	177.854	-0.303	-0.005	0.00	0	365.52	
19950627	6052	555	N2	3.7934	5014.46	21.60	21.65	666.455	781.650	375.070	177.854	-0.303	-0.005	0.00	0	365.43	
19950627	181	556	N2	3.7934	5014.46	21.69	21.51	646.534	784.220	375.109	177.860	-0.303	-0.005	0.00	0	338.60	
19950627	181	556	N2	3.7934	5014.46	21.80	21.51	646.607	784.220	375.062	177.860	-0.303	-0.005	0.00	0	338.62	
19950628	181	557	N2	3.7934	5014.46	21.53	21.73	647.304	787.393	375.093	177.882	-0.303	-0.005	0.00	0	338.29	
19950628	181	557	N2	3.7934	5014.46	21.74	21.73	647.458	787.393	375.072	177.882	-0.303	-0.005	0.00	0	338.25	
19950628	75593	558	N2	3.7934	5014.46	21.94	21.60	666.723	785.022	375.088	177.842	-0.303	-0.005	0.00	0	363.19	
19950628	75593	558	N2	3.7934	5014.46	21.99	21.60	666.812	785.022	375.056	177.842	-0.303	-0.005	0.00	0	363.28	
19950629	75593	559	N2	3.7934	5014.46	21.55	21.96	667.052	787.621	375.113	177.872	-0.303	-0.005	0.00	0	363.02	
19950629	75593	559	N2	3.7934	5014.46	21.68	21.96	667.139	787.621	375.094	177.872	-0.303	-0.005	0.00	0	362.98	
19950629	11094	560	N2	3.7934	5014.46	21.82	21.60	649.700	787.488	375.100	177.879	-0.303	-0.005	0.00	0	340.70	
19950629	11094	560	N2	3.7934	5014.46	21.95	21.60	649.834	787.488	375.103	177.879	-0.303	-0.005	0.00	0	340.70	
19950629	11094	561	N2	3.7934	5014.46	22.16	21.85	648.779	785.785	375.132	177.870	-0.303	-0.005	0.00	0	340.35	HG CONTACTED POINTER PREMATURELY
19950630	11094	561	N2	3.7934	5014.46	21.63	21.85	648.354	785.785	375.106	177.870	-0.303	-0.005	0.00	0	340.50	
19950630	10067	562	N2	3.7934	5014.46	21.95	21.70	669.363	785.119	375.095	177.826	-0.303	-0.005	0.00	0	366.53	
19950630	10067	562	N2	3.7934	5014.46	22.07	21.70	669.501	785.119	375.082	177.826	-0.303	-0.005	0.00	0	366.56	
19950630	10067	563	N2	3.7934	5014.46	22.16	21.99	670.098	786.893	375.103	177.876	-0.303	-0.005	0.00	0	366.50	
19950630	10067	563	N2	3.7934	5014.46	22.22	21.99	670.148	786.893	375.079	177.876	-0.303	-0.005	0.00	0	366.52	
19950701	4286	564	N2	3.7934	5014.46	21.99	22.17	646.696	786.320	375.098	177.880	-0.303	-0.005	0.00	0	338.09	
19950701	4286	564	N2	3.7934	5014.46	22.09	22.17	646.747	786.320	375.090	177.880	-0.303	-0.005	0.00	0	338.05	
19950701	4286	565	N2	3.7934	5014.46	22.21	22.03	646.688	785.468	375.112	177.822	-0.303	-0.005	0.00	0	338.07	
19950701	4286	565	N2	3.7934	5014.46	22.24	22.03	646.741	785.468	375.095	177.822	-0.303	-0.005	0.00	0	338.12	
19950921	66625	566	AIR	3.7934	5014.46	22.26	22.20	652.183	785.759	375.125	177.780	-0.303	-0.005	0.29	0	344.55	
19950921	66625	566	AIR	3.7934	5014.46	22.30	22.20	652.276	785.759	375.103	177.780	-0.303	-0.005	0.29	0	344.64	
19950921	66625	567	AIR	3.7934	5014.46	22.22	22.27	653.044	787.854	375.102	177.739	-0.303	-0.005	0.29	0	344.58	
19950921	66625	567	AIR	3.7934	5014.46	22.29	22.27	653.084	787.854	375.084	177.739	-0.303	-0.005	0.29	0	344.56	
19950922	66638	568	AIR	3.7934	5014.46	22.05	22.24	648.284	788.417	375.128	177.732	-0.303	-0.005	0.31	0	338.46	
19950922	66638	568	AIR	3.7934	5014.46	22.09	22.24	648.308	788.417	375.108	177.732	-0.303	-0.005	0.31	0	338.46	
19950926	66638	569	AIR	3.7934	5014.46	21.90	21.84	649.589	790.646	375.160	177.847	-0.303	-0.005	0.31	0	338.56	
19950926	66638	569	AIR	3.7934	5014.46	21.98	21.84	649.542	790.646	375.094	177.847	-0.303	-0.005	0.31	0	338.49	
19950927	66696	570	AIR	3.7934	5014.46	21.77	21.92	665.958	788.632	375.112	177.832	-0.303	-0.005	0.31	0	360.35	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 23/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19950927	66696	570	AIR	3.7934	5014.46	21.86	21.92	666.034	788.632	375.085	177.832	-0.303	-0.005	0.31	0	360.36	
19950927	66696	571	AIR	3.7934	5014.46	21.99	21.80	663.780	783.229	375.130	177.834	-0.303	-0.005	0.31	0	360.37	
19950927	66696	571	AIR	3.7934	5014.46	22.07	21.80	663.790	783.229	375.094	177.834	-0.303	-0.005	0.31	0	360.32	
19950927	71251	572	AIR	3.7934	5014.46	22.13	22.02	548.486	791.402	375.130	177.832	-0.303	-0.005	0.34	0	213.13	
19950928	71251	572	AIR	3.7934	5014.46	21.96	22.02	548.455	791.402	375.112	177.832	-0.303	-0.005	0.34	0	213.25	
19950928	71251	573	AIR	3.7934	5014.46	22.10	22.14	548.070	790.167	375.118	177.826	-0.303	-0.005	0.34	0	213.18	
19950928	71251	573	AIR	3.7934	5014.46	22.15	22.14	548.099	790.167	375.098	177.826	-0.303	-0.005	0.34	0	213.20	
19950928	67615	574	AIR	3.7934	5014.46	22.06	22.12	782.572	790.506	375.115	177.844	-0.303	-0.005	0.30	10	503.81	
19950928	67615	574	AIR	3.7934	5014.46	22.12	22.12	782.780	790.506	375.096	177.844	-0.303	-0.005	0.30	0	503.98	
19950929	67615	575	AIR	3.7934	5014.46	21.91	22.08	781.344	788.480	375.111	177.822	-0.303	-0.005	0.30	0	504.14	
19950929	67615	575	AIR	3.7934	5014.46	22.03	22.08	781.492	788.480	375.102	177.822	-0.303	-0.005	0.30	0	504.12	
19951004	71341	576	AIR	3.7934	5014.46	22.12	22.08	633.137	783.263	375.125	177.806	-0.303	-0.005	0.31	0	322.12	
19951004	71341	576	AIR	3.7934	5014.46	22.15	22.08	633.214	783.263	375.111	177.806	-0.303	-0.005	0.31	0	322.20	
19951005	71341	577	AIR	3.7934	5014.46	22.32	22.13	634.480	786.235	375.146	177.840	-0.303	-0.005	0.31	0	322.04	
19951005	71341	577	AIR	3.7934	5014.46	22.35	22.13	634.572	786.235	375.102	177.840	-0.303	-0.005	0.31	0	322.17	
19951005	71308	578	AIR	3.7934	5014.46	22.36	22.33	678.210	787.378	375.118	177.830	-0.303	-0.005	0.32	0	376.09	
19951005	71308	578	AIR	3.7934	5014.46	22.37	22.33	678.330	787.378	375.114	177.830	-0.303	-0.005	0.32	0	376.24	
19951006	71308	579	AIR	3.7934	5014.46	22.00	22.36	677.770	787.146	375.118	177.854	-0.303	-0.005	0.32	0	376.23	
19951006	71308	579	AIR	3.7934	5014.46	22.09	22.36	677.899	787.146	375.124	177.854	-0.303	-0.005	0.32	0	376.26	
19951010	71286	580	AIR	3.7934	5014.46	22.33	22.01	617.973	795.607	375.142	177.793	-0.303	-0.005	0.32	0	296.72	
19951010	71286	580	AIR	3.7934	5014.46	22.34	22.01	617.958	795.607	375.112	177.793	-0.303	-0.005	0.32	0	296.72	
19951011	71286	581	AIR	3.7934	5014.46	22.17	22.34	615.948	791.522	375.110	177.850	-0.303	-0.005	0.32	0	296.78	
19951011	71286	581	AIR	3.7934	5014.46	22.17	22.34	615.948	791.522	375.087	177.850	-0.303	-0.005	0.32	0	296.81	
19951011	71370	582	AIR	3.7934	5014.46	22.16	22.17	703.507	789.125	375.116	177.888	-0.303	-0.005	0.31	0	406.56	
19951011	71370	582	AIR	3.7934	5014.46	22.25	22.17	703.610	789.125	375.088	177.888	-0.303	-0.005	0.31	0	406.59	
19951012	71370	583	AIR	3.7934	5014.46	22.11	22.19	703.189	788.829	375.126	177.815	-0.303	-0.005	0.31	0	406.40	HG CONTACTED POINTER PREMATURELY
19951012	71370	583	AIR	3.7934	5014.46	22.16	22.19	703.266	788.829	375.100	177.815	-0.303	-0.005	0.31	0	406.46	
19951012	34819	584	AIR	3.7934	5014.46	22.19	22.12	579.169	789.349	375.116	177.848	-0.303	-0.005	0.24	0	252.04	
19951012	34819	584	AIR	3.7934	5014.46	22.21	22.12	579.220	789.349	375.109	177.848	-0.303	-0.005	0.24	0	252.09	
19951017	34819	585	AIR	3.7934	5014.46	21.74	21.60	580.372	791.892	375.137	177.802	-0.303	-0.005	0.24	11	252.37	
19951017	34819	585	AIR	3.7934	5014.46	21.89	21.60	580.474	791.892	375.134	177.802	-0.303	-0.005	0.24	11	252.36	
19951018	71479	586	AIR	3.7934	5014.46	21.96	21.75	741.386	788.660	375.135	177.829	-0.303	-0.005	0.30	0	453.58	
19951018	71479	586	AIR	3.7934	5014.46	21.98	21.75	741.380	788.660	375.102	177.829	-0.303	-0.005	0.30	0	453.58	
19951018	71479	587	AIR	3.7934	5014.46	21.92	21.97	740.198	787.732	375.125	177.869	-0.303	-0.005	0.30	10	453.26	
19951018	71479	587	AIR	3.7934	5014.46	21.97	21.97	740.468	787.732	375.116	177.869	-0.303	-0.005	0.30	0	453.52	
19951018	62807	588	AIR	3.7934	5014.46	21.89	21.94	649.106	789.512	375.114	177.818	-0.303	-0.005	0.29	0	338.79	
19951018	62807	588	AIR	3.7934	5014.46	21.93	21.94	649.145	789.512	375.116	177.818	-0.303	-0.005	0.29	0	338.78	
19951024	62807	589	AIR	3.7934	5014.46	21.86	21.50	650.980	792.718	375.134	177.821	-0.303	-0.005	0.29	0	338.81	
19951024	62807	589	AIR	3.7934	5014.46	21.94	21.50	651.047	792.718	375.088	177.821	-0.303	-0.005	0.29	0	338.85	
19951025	62817	590	AIR	3.7934	5014.46	21.91	21.89	671.750	791.417	375.134	177.832	-0.303	-0.005	0.28	0	365.66	
19951025	62817	590	AIR	3.7934	5014.46	22.00	21.89	671.829	791.417	375.084	177.832	-0.303	-0.005	0.28	0	365.70	
19951025	62817	591	AIR	3.7934	5014.46	21.68	21.93	672.278	793.340	375.124	177.854	-0.303	-0.005	0.28	0	365.55	
19951025	62817	591	AIR	3.7934	5014.46	21.82	21.93	672.435	793.340	375.100	177.854	-0.303	-0.005	0.28	0	365.59	
19951026	34891	592	AIR	3.7934	5014.46	21.76	21.71	617.708	792.313	375.131	177.840	-0.303	-0.005	0.24	0	298.39	
19951026	34891	592	AIR	3.7934	5014.46	21.85	21.71	617.750	792.313	375.103	177.840	-0.303	-0.005	0.24	0	298.38	
19951031	34891	593	AIR	3.7934	5014.46	21.57	20.99	617.216	789.988	375.116	177.821	-0.303	-0.005	0.24	0	298.35	
19951031	34891	593	AIR	3.7934	5014.46	21.69	20.99	617.338	789.988	375.132	177.821	-0.303	-0.005	0.24	0	298.36	
19951101	62814	594	AIR	3.7934	5014.46	21.37	21.60	717.041	787.541	375.136	177.857	-0.303	-0.005	0.31	0	424.78	
19951101	62814	594	AIR	3.7934	5014.46	21.55	21.60	717.185	787.541	375.106	177.857	-0.303	-0.005	0.31	0	424.72	
19951101	62814	595	AIR	3.7934	5014.46	21.70	21.43	716.788	786.084	375.110	177.836	-0.303	-0.005	0.31	0	424.73	
19951101	62814	595	AIR	3.7934	5014.46	21.80	21.43	716.912	786.084	375.108	177.836	-0.303	-0.005	0.31	0	424.74	
19951108	7361	596	N2	3.7934	5014.46	21.65	21.50	657.566	794.926	375.119	177.844	-0.303	-0.005	0.00	0	346.31	
19951108	7361	596	N2	3.7934	5014.46	21.76	21.50	657.710	794.926	375.086	177.844	-0.303	-0.005	0.00	0	346.39	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 24/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19951108	7361	597	N2	3.7934	5014.46	21.91	21.69	657.072	793.947	375.108	177.868	-0.303	-0.005	0.00	0	346.19	
19951108	7361	597	N2	3.7934	5014.46	21.94	21.69	657.116	793.947	375.077	177.868	-0.303	-0.005	0.00	0	346.24	
19951109	39361	598	N2	3.7934	5014.46	21.56	21.92	675.620	791.809	375.106	177.852	-0.303	-0.005	0.00	0	371.08	
19951109	39361	598	N2	3.7934	5014.46	21.66	21.92	675.700	791.809	375.098	177.852	-0.303	-0.005	0.00	0	371.06	
19951109	39361	599	N2	3.7934	5014.46	21.71	21.59	675.996	791.678	375.109	177.888	-0.303	-0.005	0.00	0	371.01	
19951109	39361	599	N2	3.7934	5014.46	21.89	21.59	676.190	791.678	375.110	177.888	-0.303	-0.005	0.00	0	371.01	
19960328	11094	600	N2	3.7934	5014.47	21.86	22.25	646.802	782.229	375.078	177.721	-0.303	-0.005	0.00	0	340.71	
19960328	11094	600	N2	3.7934	5014.47	21.96	22.25	646.852	782.229	375.027	177.721	-0.303	-0.005	0.00	0	340.71	
19960328	11094	601	N2	3.7934	5014.47	22.15	21.90	649.612	787.211	375.044	177.813	-0.303	-0.005	0.00	0	340.74	
19960328	11094	601	N2	3.7934	5014.47	22.19	21.90	649.665	787.211	375.007	177.813	-0.303	-0.005	0.00	0	340.80	
19960329	10067	602	N2	3.7934	5014.47	21.87	22.16	670.323	788.340	375.067	177.854	-0.303	-0.005	0.00	0	366.55	HG CONTACTED POINTER PREMATURELY
19960329	10067	602	N2	3.7934	5014.47	22.00	22.16	670.418	788.340	375.000	177.854	-0.303	-0.005	0.00	0	366.58	
19960329	10067	603	N2	3.7934	5014.47	22.19	21.91	670.408	787.197	375.040	177.774	-0.303	-0.005	0.00	0	366.58	
19960329	10067	603	N2	3.7934	5014.47	22.24	21.91	670.438	787.197	375.026	177.774	-0.303	-0.005	0.00	0	366.57	
19960402	34819	604	AIR	3.7934	5014.47	21.91	21.89	579.312	789.725	375.042	177.780	-0.303	-0.005	0.24	0	252.17	
19960402	34819	604	AIR	3.7934	5014.47	21.98	21.89	579.330	789.725	375.030	177.780	-0.303	-0.005	0.24	0	252.14	
19960403	7358	605	N2	3.7934	5014.47	21.82	21.93	657.078	791.653	375.030	177.824	-0.303	-0.005	0.00	0	347.97	
19960403	7358	605	N2	3.7934	5014.47	21.90	21.93	657.114	791.653	375.018	177.824	-0.303	-0.005	0.00	0	347.93	
19960403	7358	606	N2	3.7934	5014.47	21.77	21.85	656.678	790.800	375.018	177.752	-0.303	-0.005	0.00	0	347.90	
19960403	7358	606	N2	3.7934	5014.47	21.83	21.85	656.746	790.800	375.018	177.752	-0.303	-0.005	0.00	0	347.91	
19960404	7361	607	N2	3.7934	5014.47	22.02	21.73	656.893	793.262	375.084	177.772	-0.303	-0.005	0.00	0	346.24	
19960404	7361	607	N2	3.7934	5014.47	22.08	21.73	656.964	793.262	375.047	177.772	-0.303	-0.005	0.00	0	346.30	
19960404	7361	608	N2	3.7934	5014.47	22.15	22.04	657.690	795.494	375.053	177.769	-0.303	-0.005	0.00	0	346.23	
19960404	7361	608	N2	3.7934	5014.47	22.19	22.04	657.654	795.494	375.038	177.769	-0.303	-0.005	0.00	0	346.15	
19960924	39361	609	N2	3.7934	5014.47	22.14	21.39	676.873	791.442	375.088	177.896	-0.303	-0.005	0.00	0	371.42	
19960924	39361	609	N2	3.7934	5014.47	22.17	21.39	676.914	791.442	375.055	177.896	-0.303	-0.005	0.00	0	371.48	
19960925	39361	610	N2	3.7934	5014.47	21.30	22.15	675.299	791.614	375.080	177.836	-0.303	-0.005	0.00	0	371.48	
19960925	39361	610	N2	3.7934	5014.47	21.49	22.15	675.466	791.614	375.054	177.836	-0.303	-0.005	0.00	0	371.46	HG CONTACTED POINTER PREMATURELY
19960925	3756	611	N2	3.7934	5014.47	22.09	21.38	677.250	791.032	375.094	177.789	-0.303	-0.005	0.00	0	372.12	
19960925	3756	611	N2	3.7934	5014.47	22.15	21.38	677.425	791.032	375.094	177.789	-0.303	-0.005	0.00	0	372.26	HG CONTACTED POINTER PREMATURELY
19960925	3756	612	N2	3.7934	5014.47	22.25	22.11	675.970	789.597	375.110	177.880	-0.303	-0.005	0.00	0	372.20	HG CONTACTED POINTER PREMATURELY
19960925	3756	612	N2	3.7934	5014.47	22.29	22.11	675.988	789.597	375.096	177.880	-0.303	-0.005	0.00	0	372.19	
19961205	11081	613	N2	3.7934	5014.47	22.72	22.13	655.630	784.345	375.070	177.844	-0.303	-0.005	0.00	0	349.43	
19961205	11081	613	N2	3.7934	5014.47	22.73	22.13	655.643	784.345	375.048	177.844	-0.303	-0.005	0.00	0	349.47	
19961205	11081	614	N2	3.7934	5014.47	22.68	22.73	657.800	790.546	375.076	177.820	-0.303	-0.005	0.00	0	349.36	HG CONTACTED POINTER PREMATURELY
19961205	11081	614	N2	3.7934	5014.47	22.71	22.73	657.846	790.546	375.052	177.820	-0.303	-0.005	0.00	0	349.41	
19961206	7358	615	N2	3.7934	5014.47	22.57	22.69	655.478	788.184	375.075	177.846	-0.303	-0.005	0.00	0	347.92	
19961206	7358	615	N2	3.7934	5014.47	22.60	22.69	655.545	788.184	375.080	177.846	-0.303	-0.005	0.00	0	347.96	HG CONTACTED POINTER PREMATURELY
19961206	7358	616	N2	3.7934	5014.47	22.52	22.59	656.237	789.626	375.104	177.805	-0.303	-0.005	0.00	0	347.92	HG CONTACTED POINTER PREMATURELY
19961206	7358	616	N2	3.7934	5014.47	22.52	22.59	656.208	789.626	375.073	177.805	-0.303	-0.005	0.00	0	347.93	
19971230	11094	617	N2	3.7934	5014.49	22.34	22.00	654.625	779.719	375.021	177.706	-0.303	-0.005	0.00	0	351.15	HG CONTACTED POINTER PREMATURELY
19971230	11094	617	N2	3.7934	5014.49	22.44	22.00	654.839	779.719	374.993	177.706	-0.303	-0.005	0.00	0	351.33	
19971231	11094	618	N2	3.7934	5014.49	21.90	22.36	655.172	782.548	375.010	177.723	-0.303	-0.005	0.00	0	351.22	
19971231	11094	618	N2	3.7934	5014.49	22.02	22.36	655.285	782.548	375.002	177.723	-0.303	-0.005	0.00	0	351.22	
19971231	4289	619	N2	3.7934	5014.49	22.23	21.94	673.220	780.957	375.005	177.661	-0.303	-0.005	0.00	0	373.87	
19971231	4289	619	N2	3.7934	5014.49	22.35	21.94	673.415	780.957	375.000	177.661	-0.303	-0.005	0.00	0	373.96	HG CONTACTED POINTER PREMATURELY
19971231	4289	620	N2	3.7934	5014.49	22.37	22.29	675.022	785.109	375.012	177.712	-0.303	-0.005	0.00	0	373.86	
19971231	4289	620	N2	3.7934	5014.49	22.44	22.29	675.092	785.109	375.010	177.712	-0.303	-0.005	0.00	0	373.86	
19980115	7361	621	N2	3.7934	5014.49	22.30	21.97	659.160	788.321	375.081	177.786	-0.303	-0.005	0.00	0	351.82	
19980115	7361	621	N2	3.7934	5014.49	22.36	21.97	659.180	788.321	375.061	177.786	-0.303	-0.005	0.00	0	351.79	
19980115	7361	622	N2	3.7934	5014.49	22.39	22.32	659.274	789.119	375.088	177.795	-0.303	-0.005	0.00	0	351.82	HG JUMPED INTO CONTACT PREMATURELY-CONSTRUCTION
19980115	7361	622	N2	3.7934	5014.49	22.47	22.32	659.378	789.119	375.058	177.795	-0.303	-0.005	0.00	0	351.89	HG CONTACTED POINTER PREMATURELY

Table A7: Manometric Reference Gas Measurements: Original Data. Page 25/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19980116	11076	623	N2	3.7934	5014.49	21.91	22.41	673.949	785.108	375.106	177.772	-0.303	-0.005	0.00	0	373.22	HG JUMPED INTO CONTACT PREMATURELY-CONSTRUCTION
19980116	11076	623	N2	3.7934	5014.49	21.99	22.41	673.910	785.108	375.081	177.772	-0.303	-0.005	0.00	0	373.09	HG JUMPED INTO CONTACT PREMATURELY-CONSTRUCTION
19980116	11076	623	N2	3.7934	5014.49	22.14	22.41	674.217	785.108	375.092	177.772	-0.303	-0.005	0.00	0	373.26	HG JUMPED INTO CONTACT VERY PREMATURELY
19980116	11076	624	N2	3.7934	5014.49	22.43	21.94	675.518	786.227	375.089	177.771	-0.303	-0.005	0.00	0	373.19	
19980120	11076	624	N2	3.7934	5014.49	21.96	21.94	675.153	786.227	375.113	177.771	-0.303	-0.005	0.00	0	373.33	HG CONTACTED POINTER PREMATURELY
19980120	11076	624	N2	3.7934	5014.49	22.00	21.94	675.120	786.227	375.070	177.771	-0.303	-0.005	0.00	0	373.29	
19980204	11092	625	N2	3.7934	5014.49	21.95	22.21	650.886	774.698	375.044	177.734	-0.303	-0.005	0.00	0	350.09	
19980204	11092	625	N2	3.7934	5014.49	22.04	22.21	651.048	774.698	375.046	177.734	-0.303	-0.005	0.00	0	350.18	
19980204	11092	626	N2	3.7934	5014.49	22.19	21.98	656.096	784.999	375.053	177.842	-0.303	-0.005	0.00	0	350.14	
19980204	11092	626	N2	3.7934	5014.49	22.24	21.98	656.250	784.999	375.052	177.842	-0.303	-0.005	0.00	0	350.27	HG JUMPED INTO CONTACT PREMATURELY
19980205	11081	627	N2	3.7934	5014.49	22.45	22.22	656.258	786.464	375.083	177.794	-0.303	-0.005	0.00	0	349.40	HG JUMPED INTO CONTACT PREMATURELY
19980205	11081	627	N2	3.7934	5014.49	22.47	22.22	656.300	786.464	375.030	177.794	-0.303	-0.005	0.00	0	349.50	
19980206	11081	628	N2	3.7934	5014.49	22.00	22.45	655.124	785.542	375.018	177.786	-0.303	-0.005	0.00	0	349.44	
19980206	11081	628	N2	3.7934	5014.49	22.09	22.45	655.181	785.542	375.022	177.786	-0.303	-0.005	0.00	0	349.40	
19980206	3756	629	N2	3.7934	5014.49	22.19	22.03	672.898	783.456	375.059	177.793	-0.303	-0.005	0.00	0	372.11	
19980206	3756	629	N2	3.7934	5014.49	22.28	22.03	673.000	783.456	375.014	177.793	-0.303	-0.005	0.00	0	372.17	
19980206	3756	630	N2	3.7934	5014.49	22.45	22.23	672.855	783.212	375.087	177.784	-0.303	-0.005	0.00	0	372.08	HG CONTACTED POINTER PREMATURELY
19980206	3756	630	N2	3.7934	5014.49	22.48	22.23	672.830	783.212	375.020	177.784	-0.303	-0.005	0.00	0	372.09	
19980310	67615	631	AIR	3.7934	5014.49	22.24	22.00	782.704	790.230	375.049	177.791	-0.303	-0.005	0.30	10	503.69	
19980310	67615	631	AIR	3.7934	5014.49	22.34	22.00	783.068	790.230	375.002	177.791	-0.303	-0.005	0.30	0	504.02	
19980311	71251	632	AIR	3.7934	5014.49	22.23	22.27	543.920	775.601	375.070	177.802	-0.303	-0.005	0.34	0	213.17	
19980311	71251	632	AIR	3.7934	5014.49	22.31	22.27	543.943	775.601	375.031	177.802	-0.303	-0.005	0.34	0	213.18	
19980311	66696	633	AIR	3.7934	5014.49	22.31	22.28	665.629	787.906	375.058	177.748	-0.303	-0.005	0.31	0	360.15	
19980311	66696	633	AIR	3.7934	5014.49	22.42	22.28	665.844	787.906	375.038	177.748	-0.303	-0.005	0.31	0	360.30	
19980312	71479	634	AIR	3.7934	5014.49	21.96	22.36	737.184	783.033	375.030	177.814	-0.303	-0.005	0.30	0	453.64	
19980312	71479	634	AIR	3.7934	5014.49	22.14	22.36	737.364	783.033	375.020	177.814	-0.303	-0.005	0.30	0	453.58	
19980312	34819	635	AIR	3.7934	5014.49	22.48	22.03	577.620	784.061	375.052	177.754	-0.303	-0.005	0.24	0	252.00	
19980312	34819	635	AIR	3.7934	5014.49	22.57	22.03	577.710	784.061	375.013	177.754	-0.303	-0.005	0.24	0	252.08	
19980313	67615	636	AIR	3.7934	5014.49	22.33	22.51	778.074	783.746	375.054	177.760	-0.303	-0.005	0.30	0	504.00	
19980313	67615	636	AIR	3.7934	5014.49	22.40	22.51	778.272	783.746	375.025	177.760	-0.303	-0.005	0.30	0	504.16	
19980318	71286	637	AIR	3.7934	5014.49	22.18	22.13	615.232	789.667	375.095	177.788	-0.303	-0.005	0.32	0	296.55	
19980318	71286	637	AIR	3.7934	5014.49	22.27	22.13	615.356	789.667	375.040	177.788	-0.303	-0.005	0.32	0	296.67	
19980318	71370	638	AIR	3.7934	5014.49	22.39	22.22	700.466	783.234	375.076	177.792	-0.303	-0.005	0.31	0	406.42	HG CONTACTED POINTER PREMATURELY
19980318	71370	638	AIR	3.7934	5014.49	22.45	22.22	700.584	783.234	375.030	177.792	-0.303	-0.005	0.31	0	406.54	
19980319	71251	639	AIR	3.7934	5014.49	22.33	22.42	546.010	783.144	375.035	177.759	-0.303	-0.005	0.34	0	213.19	
19980319	71251	639	AIR	3.7934	5014.49	22.39	22.42	546.049	783.144	375.062	177.759	-0.303	-0.005	0.34	0	213.16	
19980319	66696	640	AIR	3.7934	5014.49	22.43	22.36	664.000	784.415	375.062	177.791	-0.303	-0.005	0.31	0	360.15	HG JUMPED INTO CONTACT PREMATURELY
19980319	66696	640	AIR	3.7934	5014.49	22.48	22.36	664.097	784.415	375.042	177.791	-0.303	-0.005	0.31	0	360.23	
19980401	71341	641	AIR	3.7934	5014.49	22.17	22.27	633.112	784.235	375.074	177.783	-0.303	-0.005	0.31	10	321.78	
19980401	71341	641	AIR	3.7934	5014.49	22.24	22.27	633.410	784.235	375.032	177.783	-0.303	-0.005	0.31	0	322.13	
19980402	71308	642	AIR	3.7934	5014.49	21.94	22.20	676.298	784.167	375.052	177.814	-0.303	-0.005	0.32	0	376.16	
19980402	71308	642	AIR	3.7934	5014.49	22.20	22.20	676.566	784.167	375.078	177.814	-0.303	-0.005	0.32	0	376.11	
19980402	71479	643	AIR	3.7934	5014.49	22.39	22.01	739.458	784.445	375.060	177.812	-0.303	-0.005	0.30	11	454.12	
19980402	71479	643	AIR	3.7934	5014.49	22.44	22.01	739.626	784.445	374.984	177.812	-0.303	-0.005	0.30	11	454.35	
19980403	34819	644	AIR	3.7934	5014.49	21.76	22.41	579.006	790.190	375.056	177.722	-0.303	-0.005	0.24	0	252.16	
19980403	34819	644	AIR	3.7934	5014.49	21.95	22.41	579.136	790.190	375.060	177.722	-0.303	-0.005	0.24	0	252.14	
19980414	66625	645	AIR	3.7934	5014.49	22.21	21.89	653.740	788.853	375.059	177.752	-0.303	-0.005	0.29	0	344.48	
19980414	66625	645	AIR	3.7934	5014.49	22.28	21.89	653.934	788.853	375.044	177.752	-0.303	-0.005	0.29	0	344.65	
19980414	66638	646	AIR	3.7934	5014.49	22.27	22.23	647.300	786.060	375.024	177.796	-0.303	-0.005	0.31	0	338.42	
19980414	66638	646	AIR	3.7934	5014.49	22.31	22.23	647.406	786.060	375.030	177.796	-0.303	-0.005	0.31	0	338.50	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 26/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19980415	71370	647	AIR	3.7934	5014.49	21.98	22.29	702.792	788.310	375.074	177.766	-0.303	-0.005	0.31	0	406.62	
19980415	71370	647	AIR	3.7934	5014.49	22.10	22.29	702.878	788.310	375.040	177.766	-0.303	-0.005	0.31	0	406.59	
19980415	71286	648	AIR	3.7934	5014.49	22.19	22.01	614.488	787.285	375.045	177.716	-0.303	-0.005	0.32	0	296.67	
19980415	71286	648	AIR	3.7934	5014.49	22.24	22.01	614.556	787.285	375.060	177.716	-0.303	-0.005	0.32	0	296.68	
19980506	2408	649	N2	3.7934	5014.49	21.12	21.15	533.938	787.356	375.110	177.804	-0.303	-0.005	0.00	0	196.94	
19980506	2408	649	N2	3.7934	5014.49	21.31	21.15	534.006	787.356	375.110	177.804	-0.303	-0.005	0.00	0	196.89	
19980506	35316	650	N2	3.7934	5014.49	21.86	21.20	754.684	784.756	375.009	177.808	-0.303	-0.005	0.00	0	472.87	
19980506	35316	650	N2	3.7934	5014.49	21.99	21.20	754.960	784.756	375.086	177.808	-0.303	-0.005	0.00	0	472.90	
19980507	66638	651	AIR	3.7934	5014.49	21.34	21.81	647.770	787.965	375.116	177.789	-0.303	-0.005	0.31	0	338.46	
19980507	66638	651	AIR	3.7934	5014.49	21.54	21.81	647.962	787.965	375.070	177.789	-0.303	-0.005	0.31	0	338.51	
19980507	71308	652	AIR	3.7934	5014.49	21.79	21.41	677.990	786.200	375.088	177.792	-0.303	-0.005	0.32	0	376.09	
19980507	71308	652	AIR	3.7934	5014.49	21.90	21.41	678.161	786.200	375.079	177.792	-0.303	-0.005	0.32	0	376.17	HG CONTACTED POINTER PREMATURELY
19980508	4274	653	N2	3.7934	5014.49	21.43	21.82	571.226	788.124	375.132	177.784	-0.303	-0.005	0.00	0	243.30	
19980508	4274	653	N2	3.7934	5014.49	21.58	21.82	571.332	788.124	375.099	177.784	-0.303	-0.005	0.00	0	243.34	
19980707	35299	654	N2	3.7934	5014.49	22.11	21.27	709.898	786.759	375.176	177.861	-0.303	-0.005	0.00	0	415.11	
19980707	35299	654	N2	3.7934	5014.49	22.17	21.27	710.022	786.759	375.118	177.861	-0.303	-0.005	0.00	0	415.24	
19980708	7366	655	N2	3.7934	5014.49	21.73	22.14	597.113	785.933	375.141	177.826	-0.303	-0.005	0.00	0	276.53	
19980708	7366	655	N2	3.7934	5014.49	21.84	22.14	597.280	785.933	375.108	177.826	-0.303	-0.005	0.00	0	276.67	
19980709	71341	656	AIR	3.7934	5014.49	21.40	21.77	633.570	785.361	375.147	177.829	-0.303	-0.005	0.31	0	322.00	
19980709	71341	656	AIR	3.7934	5014.49	21.55	21.77	633.836	785.361	375.126	177.829	-0.303	-0.005	0.31	0	322.19	
19980709	66625	657	AIR	3.7934	5014.49	22.07	21.47	651.762	783.482	375.138	177.819	-0.303	-0.005	0.29	0	344.66	
19980709	66625	657	AIR	3.7934	5014.49	22.18	21.47	651.912	783.482	375.119	177.819	-0.303	-0.005	0.29	0	344.73	
19980710	71479	658	AIR	3.7934	5014.49	21.52	22.09	739.151	786.544	375.142	177.822	-0.303	-0.005	0.30	0	453.63	
19980710	71479	658	AIR	3.7934	5014.49	21.69	22.09	739.359	786.544	375.116	177.822	-0.303	-0.005	0.30	0	453.64	
19980717	7361	659	N2	3.7934	5014.49	22.10	21.45	656.451	781.371	375.148	177.835	-0.303	-0.005	0.00	0	352.01	
19980717	7361	659	N2	3.7934	5014.49	22.19	21.45	656.503	781.371	375.116	177.835	-0.303	-0.005	0.00	0	352.00	
19980804	7361	660	N2	3.7934	5014.49	22.16	21.76	657.898	785.005	375.124	177.857	-0.303	-0.005	0.00	0	352.06	
19980804	7361	660	N2	3.7934	5014.49	22.23	21.76	657.987	785.005	375.118	177.857	-0.303	-0.005	0.00	0	352.09	
19980805	7358	661	N2	3.7934	5014.49	22.00	22.19	654.398	783.164	375.116	177.782	-0.303	-0.005	0.00	0	349.45	
19980805	7358	661	N2	3.7934	5014.49	22.07	22.19	654.476	783.164	375.132	177.782	-0.303	-0.005	0.00	0	349.44	
19980805	7358	662	N2	3.7934	5014.49	22.19	22.03	654.280	782.172	375.126	177.829	-0.303	-0.005	0.00	0	349.46	
19980805	7358	662	N2	3.7934	5014.49	22.24	22.03	654.307	782.172	375.096	177.829	-0.303	-0.005	0.00	0	349.47	
19980806	39361	663	N2	3.7934	5014.49	21.61	22.21	676.892	787.173	375.136	177.807	-0.303	-0.005	0.00	0	375.75	
19980806	39361	663	N2	3.7934	5014.49	21.72	22.21	676.986	787.173	375.120	177.807	-0.303	-0.005	0.00	0	375.74	
19980806	39361	664	N2	3.7934	5014.49	21.93	21.67	675.970	783.399	375.149	177.845	-0.303	-0.005	0.00	0	375.78	HG CONTACTED POINTER PREMATURELY
19980806	39361	664	N2	3.7934	5014.49	21.98	21.67	676.034	783.399	375.096	177.845	-0.303	-0.005	0.00	0	375.86	
19980806	4289	665	N2	3.7934	5014.49	22.09	21.94	675.230	785.451	375.122	177.856	-0.303	-0.005	0.00	0	373.77	HG JUMPED INTO CONTACT PREMATURELY
19980806	4289	665	N2	3.7934	5014.49	22.16	21.94	675.390	785.451	375.080	177.856	-0.303	-0.005	0.00	0	373.93	
19980807	4289	666	N2	3.7934	5014.49	21.63	22.12	674.118	784.367	375.143	177.800	-0.303	-0.005	0.00	0	373.85	
19980807	4289	666	N2	3.7934	5014.49	21.75	22.12	674.250	784.367	375.126	177.800	-0.303	-0.005	0.00	0	373.87	
19980812	6071	667	N2	3.7934	5014.49	22.24	22.62	624.263	785.763	375.132	177.795	-0.303	-0.005	0.00	0	310.51	
19980812	6071	667	N2	3.7934	5014.49	22.28	22.62	624.340	785.763	375.141	177.795	-0.303	-0.005	0.00	0	310.55	HG CONTACTED POINTER PREMATURELY
19980812	1540	668	N2	3.7934	5014.49	22.50	22.23	680.619	784.905	375.145	177.926	-0.303	-0.005	0.00	0	380.70	
19980812	1540	668	N2	3.7934	5014.49	22.63	22.23	680.755	784.905	375.112	177.926	-0.303	-0.005	0.00	0	380.73	
19980813	2408	669	N2	3.7934	5014.49	22.55	22.54	533.609	785.914	375.132	177.840	-0.303	-0.005	0.00	0	196.95	
19980813	2408	669	N2	3.7934	5014.49	22.55	22.54	533.596	785.914	375.116	177.840	-0.303	-0.005	0.00	0	196.95	
19980813	35316	670	N2	3.7934	5014.49	22.41	22.55	752.403	782.587	375.119	177.890	-0.303	-0.005	0.00	0	472.98	
19980813	35316	670	N2	3.7934	5014.49	22.50	22.55	752.480	782.587	375.104	177.890	-0.303	-0.005	0.00	0	472.94	
19980819	6078	671	N2	3.7934	5014.49	22.12	21.69	624.270	783.531	375.112	177.870	-0.303	-0.005	0.00	0	310.82	
19980819	6078	671	N2	3.7934	5014.49	22.22	21.69	624.351	783.531	375.084	177.870	-0.303	-0.005	0.00	0	310.85	
19980820	39272	672	N2	3.7934	5014.49	22.18	22.15	664.583	785.263	375.106	177.922	-0.303	-0.005	0.00	0	360.80	
19980820	39272	672	N2	3.7934	5014.49	22.25	22.15	664.590	785.263	375.120	177.922	-0.303	-0.005	0.00	0	360.70	
19980820	4274	673	N2	3.7934	5014.49	22.40	22.20	570.830	785.367	375.113	177.837	-0.303	-0.005	0.00	0	243.43	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 27/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19980820	4274	673	N2	3.7934	5014.49	22.40	22.20	570.852	785.367	375.070	177.837	-0.303	-0.005	0.00	0	243.52	
19980821	35299	674	N2	3.7934	5014.49	22.13	22.40	707.874	785.216	375.116	177.880	-0.303	-0.005	0.00	0	415.37	
19980821	35299	674	N2	3.7934	5014.49	22.19	22.40	707.832	785.216	375.126	177.880	-0.303	-0.005	0.00	0	415.22	
19980908	4296	675	N2	3.7934	5014.49	22.21	22.05	633.638	787.891	375.120	177.847	-0.303	-0.005	0.00	0	320.53	
19980908	4296	675	N2	3.7934	5014.49	22.32	22.05	633.823	787.891	375.130	177.847	-0.303	-0.005	0.00	0	320.62	
19980909	39256	676	N2	3.7934	5014.49	22.17	22.25	650.660	780.945	375.120	177.890	-0.303	-0.005	0.00	0	345.95	
19980909	39256	676	N2	3.7934	5014.49	22.28	22.25	650.790	780.945	375.114	177.890	-0.303	-0.005	0.00	0	345.99	
19980909	7366	677	N2	3.7934	5014.49	22.72	22.21	597.308	784.305	375.114	177.844	-0.303	-0.005	0.00	0	276.65	
19980909	7366	677	N2	3.7934	5014.49	22.73	22.21	597.366	784.305	375.100	177.844	-0.303	-0.005	0.00	0	276.73	HG CONTACTED POINTER PREMATURELY
19980910	1540	678	N2	3.7934	5014.49	22.45	22.73	678.128	781.105	375.103	177.842	-0.303	-0.005	0.00	0	380.71	
19980910	1540	678	N2	3.7934	5014.49	22.50	22.73	678.213	781.105	375.101	177.842	-0.303	-0.005	0.00	0	380.75	
19981020	2399	679	N2	3.7934	5014.5	22.24	21.98	634.160	782.587	375.076	177.829	-0.303	-0.005	0.00	0	323.92	
19981020	2399	679	N2	3.7934	5014.5	22.30	21.98	634.330	782.587	375.060	177.829	-0.303	-0.005	0.00	0	324.09	
19981020	39239	680	N2	3.7934	5014.5	22.37	22.27	640.351	780.780	375.070	177.832	-0.303	-0.005	0.00	0	332.88	HG CONTACTED POINTER PREMATURELY
19981020	39239	680	N2	3.7934	5014.5	22.41	22.27	640.330	780.780	375.046	177.832	-0.303	-0.005	0.00	0	332.83	
19981021	6071	681	N2	3.7934	5014.5	22.01	22.38	623.027	782.820	375.086	177.779	-0.303	-0.005	0.00	0	310.50	
19981021	6071	681	N2	3.7934	5014.5	22.11	22.38	623.169	782.820	375.054	177.779	-0.303	-0.005	0.00	0	310.61	HG CONTACTED POINTER PREMATURELY
19981021	39272	682	N2	3.7934	5014.5	22.14	22.05	663.368	782.632	375.070	177.769	-0.303	-0.005	0.00	0	360.72	HG CONTACTED POINTER PREMATURELY
19981021	39272	682	N2	3.7934	5014.5	22.21	22.05	663.382	782.632	375.042	177.769	-0.303	-0.005	0.00	0	360.68	
19981022	6078	683	N2	3.7934	5014.5	21.86	22.17	624.683	785.881	375.060	177.773	-0.303	-0.005	0.00	0	310.97	
19981022	6078	683	N2	3.7934	5014.5	21.95	22.17	624.717	785.881	375.079	177.773	-0.303	-0.005	0.00	0	310.89	
19981105	4296	684	N2	3.7934	5014.5	22.21	22.07	633.216	786.987	375.086	177.817	-0.303	-0.005	0.00	0	320.53	
19981105	4296	684	N2	3.7934	5014.5	22.26	22.07	633.361	786.987	375.060	177.817	-0.303	-0.005	0.00	0	320.68	HG CONTACTED POINTER PREMATURELY
19981105	39256	685	N2	3.7934	5014.5	22.25	22.24	651.918	783.585	375.047	177.824	-0.303	-0.005	0.00	0	345.96	
19981105	39256	685	N2	3.7934	5014.5	22.34	22.24	651.924	783.585	375.025	177.824	-0.303	-0.005	0.00	0	345.89	
19981106	2399	686	N2	3.7934	5014.5	21.98	22.29	635.519	786.839	375.062	177.780	-0.303	-0.005	0.00	0	324.00	
19981106	2399	686	N2	3.7934	5014.5	22.07	22.29	635.526	786.839	375.022	177.780	-0.303	-0.005	0.00	0	323.96	
19981106	39239	687	N2	3.7934	5014.5	22.27	22.02	642.070	784.770	375.060	177.792	-0.303	-0.005	0.00	0	332.65	
19981106	39239	687	N2	3.7934	5014.5	22.31	22.02	642.172	784.770	375.040	177.792	-0.303	-0.005	0.00	0	332.76	
19981216	62814	688	AIR	3.7934	5014.5	22.60	22.24	715.150	783.863	374.994	177.736	-0.303	-0.005	0.31	0	424.17	HG JUMPED INTO CONTACT PREMATURELY
19981216	62814	688	AIR	3.7934	5014.5	22.62	22.24	715.517	783.863	374.948	177.736	-0.303	-0.005	0.31	0	424.66	
19981217	62814	689	AIR	3.7934	5014.5	22.56	22.60	717.465	788.206	374.988	177.704	-0.303	-0.005	0.31	0	424.62	
19981217	62814	689	AIR	3.7934	5014.5	22.64	22.60	717.498	788.206	374.946	177.704	-0.303	-0.005	0.31	0	424.59	
19981217	62817	690	AIR	3.7934	5014.5	22.77	22.60	668.750	785.375	374.990	177.742	-0.303	-0.005	0.28	0	365.47	HG JUMPED INTO CONTACT PREMATURELY
19981217	62817	690	AIR	3.7934	5014.5	22.82	22.60	668.842	785.375	374.964	177.742	-0.303	-0.005	0.28	0	365.55	
19981217	62817	691	AIR	3.7934	5014.5	22.89	22.78	669.203	786.386	374.982	177.692	-0.303	-0.005	0.28	0	365.49	
19981217	62817	691	AIR	3.7934	5014.5	22.93	22.78	669.286	786.386	374.970	177.692	-0.303	-0.005	0.28	0	365.55	
19990128	39354	692	N2	3.7934	5014.5	22.02	21.63	662.075	792.251	374.993	177.718	-0.303	-0.005	0.00	0	353.16	HG CONTACTED POINTER PREMATURELY
19990128	39354	692	N2	3.7934	5014.5	22.12	21.63	662.237	792.251	374.922	177.718	-0.303	-0.005	0.00	0	353.32	
19990129	39354	693	N2	3.7934	5014.5	21.39	22.07	660.028	789.844	374.939	177.760	-0.303	-0.005	0.00	0	353.46	
19990129	39354	693	N2	3.7934	5014.5	21.58	22.07	660.289	789.844	374.951	177.760	-0.303	-0.005	0.00	0	353.53	HG CONTACTED POINTER PREMATURELY
19990129	10067	694	N2	3.7934	5014.5	22.04	21.46	678.662	786.709	374.936	177.712	-0.303	-0.005	0.00	0	376.84	
19990129	10067	694	N2	3.7934	5014.5	22.13	21.46	678.620	786.709	374.868	177.712	-0.303	-0.005	0.00	0	376.75	
19990129	10067	695	N2	3.7934	5014.5	22.26	22.08	680.460	791.060	374.926	177.672	-0.303	-0.005	0.00	0	376.91	
19990201	10067	695	N2	3.7934	5014.5	22.09	22.08	680.194	791.060	374.976	177.672	-0.303	-0.005	0.00	0	376.75	
19990224	39361	696	N2	3.7934	5014.5	23.00	22.46	679.715	790.334	374.955	177.659	-0.303	-0.005	0.00	0	375.91	
19990224	39361	696	N2	3.7934	5014.5	23.00	22.46	679.590	790.334	374.949	177.659	-0.303	-0.005	0.00	0	375.76	
19990225	39361	697	N2	3.7934	5014.5	22.57	23.00	677.522	787.763	374.978	177.650	-0.303	-0.005	0.00	0	376.03	
19990225	39361	697	N2	3.7934	5014.5	22.65	23.00	677.522	787.763	375.005	177.650	-0.303	-0.005	0.00	0	375.89	
19990225	7358	698	N2	3.7934	5014.5	22.88	22.59	655.916	785.671	375.001	177.682	-0.303	-0.005	0.00	0	349.39	
19990225	7358	698	N2	3.7934	5014.5	22.88	22.59	655.860	785.671	374.978	177.682	-0.303	-0.005	0.00	0	349.35	
19990226	7358	699	N2	3.7934	5014.5	22.32	22.88	657.298	790.439	374.953	177.679	-0.303	-0.005	0.00	0	349.50	
19990226	7358	699	N2	3.7934	5014.5	22.48	22.88	657.424	790.439	374.932	177.679	-0.303	-0.005	0.00	0	349.49	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 28/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
19990302	66556	700	AIR	3.7934	5014.5	22.81	22.72	457.190	788.545	375.048	177.710	-0.303	-0.005	0.37	0	100.98	HG CONTACTED POINTER PREMATURELY
19990302	66556	700	AIR	3.7934	5014.5	22.88	22.72	457.114	788.545	374.976	177.710	-0.303	-0.005	0.37	0	100.95	
19990303	66556	701	AIR	3.7934	5014.5	22.37	22.85	456.577	785.513	375.002	177.672	-0.303	-0.005	0.37	0	100.98	
19990303	66556	701	AIR	3.7934	5014.5	22.46	22.85	456.506	785.513	374.957	177.672	-0.303	-0.005	0.37	0	100.91	
19990303	110	702	AIR	3.7934	5014.5	22.61	22.39	573.680	785.795	375.004	177.668	-0.303	-0.005	0.29	0	246.55	
19990303	110	702	AIR	3.7934	5014.5	22.64	22.39	573.641	785.795	374.988	177.668	-0.303	-0.005	0.29	0	246.49	
19990304	110	703	AIR	3.7934	5014.5	22.14	22.61	573.514	786.956	374.991	177.666	-0.303	-0.005	0.29	0	246.50	
19990304	110	703	AIR	3.7934	5014.5	22.22	22.61	573.516	786.956	374.973	177.666	-0.303	-0.005	0.29	0	246.45	
19990304	111	704	AIR	3.7934	5014.5	22.36	22.18	635.110	784.386	374.990	177.658	-0.303	-0.005	0.29	0	323.93	HG CONTACTED POINTER PREMATURELY
19990304	111	704	AIR	3.7934	5014.5	22.42	22.18	635.091	784.386	374.964	177.658	-0.303	-0.005	0.29	0	323.87	
19990305	111	705	AIR	3.7934	5014.5	22.27	22.38	636.070	787.308	374.978	177.675	-0.303	-0.005	0.29	0	323.93	
19990305	111	705	AIR	3.7934	5014.5	22.34	22.38	636.098	787.308	374.983	177.675	-0.303	-0.005	0.29	0	323.88	
19990310	103	706	AIR	3.7934	5014.5	22.25	22.32	656.196	788.325	374.950	177.670	-0.303	-0.005	0.31	11	348.38	EXTRACTION BLUNDER
19990310	103	706	AIR	3.7934	5014.5	22.28	22.32	656.186	788.325	374.960	177.670	-0.303	-0.005	0.31	11	348.32	HG JUMPED INTO CONTACT PREMATURELY
19990310	103	707	AIR	3.7934	5014.5	22.24	22.26	659.141	786.830	374.980	177.609	-0.303	-0.005	0.31	0	352.78	HG JUMPED INTO CONTACT PREMATURELY
19990310	103	707	AIR	3.7934	5014.5	22.30	22.26	659.222	786.830	374.950	177.609	-0.303	-0.005	0.31	0	352.84	HG JUMPED INTO CONTACT PREMATURELY
19990311	139	708	AIR	3.7934	5014.5	22.08	22.26	666.430	788.959	374.963	177.657	-0.303	-0.005	0.31	0	360.86	
19990311	139	708	AIR	3.7934	5014.5	22.15	22.26	666.481	788.959	374.952	177.657	-0.303	-0.005	0.31	0	360.84	
19990311	139	709	AIR	3.7934	5014.5	22.38	22.11	665.551	786.534	374.938	177.686	-0.303	-0.005	0.31	0	360.66	
19990311	139	709	AIR	3.7934	5014.5	22.46	22.11	665.682	786.534	374.955	177.686	-0.303	-0.005	0.31	0	360.70	
19990316	107	710	AIR	3.7934	5014.5	22.38	22.42	739.829	787.600	374.978	177.692	-0.303	-0.005	0.31	0	452.91	HG JUMPED INTO CONTACT PREMATURELY
19990316	107	710	AIR	3.7934	5014.5	22.41	22.42	739.871	787.600	374.924	177.692	-0.303	-0.005	0.31	0	452.99	
19990317	107	711	AIR	3.7934	5014.5	22.35	22.39	738.844	785.674	374.950	177.702	-0.303	-0.005	0.31	0	453.16	
19990317	107	711	AIR	3.7934	5014.5	22.42	22.39	738.901	785.674	374.926	177.702	-0.303	-0.005	0.31	0	453.15	
19990317	103	712	AIR	3.7934	5014.5	22.63	22.38	658.619	785.993	374.932	177.730	-0.303	-0.005	0.31	0	352.40	
19990317	103	712	AIR	3.7934	5014.5	22.66	22.38	658.722	785.993	374.930	177.730	-0.303	-0.005	0.31	0	352.49	
19990318	101	713	AIR	3.7934	5014.5	22.34	22.64	693.786	787.716	374.976	177.732	-0.303	-0.005	0.31	0	395.87	HG CONTACTED POINTER PREMATURELY
19990318	101	713	AIR	3.7934	5014.5	22.43	22.64	693.929	787.716	374.950	177.732	-0.303	-0.005	0.31	0	395.95	
19990318	101	714	AIR	3.7934	5014.5	22.54	22.37	695.896	790.427	374.946	177.737	-0.303	-0.005	0.31	0	396.11	
19990318	101	714	AIR	3.7934	5014.5	22.58	22.37	695.925	790.427	374.932	177.737	-0.303	-0.005	0.31	0	396.10	
19990324	136	715	AIR	3.7934	5014.5	22.76	22.33	686.102	793.956	374.978	177.700	-0.303	-0.005	0.31	0	381.35	
19990324	136	715	AIR	3.7934	5014.5	22.74	22.33	686.154	793.956	374.960	177.700	-0.303	-0.005	0.31	0	381.47	
19990325	136	716	AIR	3.7934	5014.5	22.41	22.75	680.973	785.450	374.962	177.694	-0.303	-0.005	0.31	0	381.36	
19990325	136	716	AIR	3.7934	5014.5	22.50	22.75	681.000	785.450	374.944	177.694	-0.303	-0.005	0.31	0	381.30	
19990325	105	717	AIR	3.7934	5014.5	22.57	22.47	672.184	786.580	374.964	177.672	-0.303	-0.005	0.31	0	369.08	
19990325	105	717	AIR	3.7934	5014.5	22.58	22.47	672.274	786.580	374.934	177.672	-0.303	-0.005	0.31	0	369.22	
19990326	105	718	AIR	3.7934	5014.5	22.04	22.57	671.716	786.219	374.962	177.713	-0.303	-0.005	0.31	0	369.58	
19990326	105	718	AIR	3.7934	5014.5	22.12	22.57	671.790	786.219	374.950	177.713	-0.303	-0.005	0.31	0	369.58	
19990330	103	719	AIR	3.7934	5014.5	22.81	22.47	666.882	802.089	374.973	177.584	-0.303	-0.005	0.31	0	353.09	
19990330	103	719	AIR	3.7934	5014.5	22.81	22.47	666.864	802.089	374.952	177.584	-0.303	-0.005	0.31	0	353.10	
19990331	105	720	AIR	3.7934	5014.5	22.50	22.81	667.050	786.906	374.998	177.742	-0.303	-0.005	0.31	11	363.02	HG JUMPED INTO CONTACT PREMATURELY
19990331	105	720	AIR	3.7934	5014.5	22.50	22.81	667.227	786.906	374.970	177.742	-0.303	-0.005	0.31	11	363.27	EXTRACTION BLUNDER
19990331	105	720	AIR	3.7934	5014.5	22.53	22.81	667.330	786.906	374.950	177.742	-0.303	-0.005	0.31	11	363.39	EXTRACTION BLUNDER
19990413	105	721	AIR	3.7934	5014.5	22.48	22.09	674.341	789.605	374.942	177.650	-0.303	-0.005	0.31	0	369.56	
19990413	105	721	AIR	3.7934	5014.5	22.55	22.09	674.135	789.605	374.912	177.650	-0.303	-0.005	0.31	0	369.25	
19990414	35355	722	N2	3.7934	5014.5	22.77	22.52	663.218	794.077	375.034	177.772	-0.303	-0.005	0.00	0	353.67	
19990414	35355	722	N2	3.7934	5014.5	22.72	22.52	663.083	794.077	375.009	177.772	-0.303	-0.005	0.00	0	353.60	
19990414	35355	723	N2	3.7934	5014.5	22.47	22.75	661.627	791.770	375.048	177.862	-0.303	-0.005	0.00	0	353.74	HG CONTACTED POINTER PREMATURELY
19990414	35355	723	N2	3.7934	5014.5	22.49	22.75	661.541	791.770	375.000	177.862	-0.303	-0.005	0.00	0	353.67	
19990415	39354	724	N2	3.7934	5014.5	22.37	22.47	659.336	786.889	375.036	177.726	-0.303	-0.005	0.00	0	353.43	
19990415	39354	724	N2	3.7934	5014.5	22.38	22.47	659.305	786.889	375.004	177.726	-0.303	-0.005	0.00	0	353.42	
19990415	39354	725	N2	3.7934	5014.5	22.42	22.37	660.574	789.031	375.022	177.772	-0.303	-0.005	0.00	0	353.58	
19990415	39354	725	N2	3.7934	5014.5	22.44	22.37	660.510	789.031	375.011	177.772	-0.303	-0.005	0.00	0	353.49	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 29/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
20041217	66696	726	AIR	3.7934	5014.57	23.36	22.94	653.540	764.975	371.394	174.066	-0.271	+0.135	0.31	0	360.51	
20041217	66696	726	AIR	3.7934	5014.57	23.40	22.94	653.593	764.975	371.414	174.066	-0.271	+0.135	0.31	0	360.50	
20041217	66696	727	AIR	3.7934	5014.57	23.09	23.34	653.863	767.070	371.459	174.127	-0.271	+0.135	0.31	0	360.46	
20050103	66696	727	AIR	3.7934	5014.57	23.18	23.34	654.177	767.070	371.476	174.127	-0.271	+0.135	0.31	0	360.73	
20050107	71308	728	AIR	3.7934	5014.57	23.34	23.32	662.254	758.508	371.492	174.157	-0.271	+0.135	0.32	0	376.26	
20050107	71308	728	AIR	3.7934	5014.57	23.42	23.32	662.432	758.508	371.448	174.157	-0.271	+0.135	0.32	0	376.44	
20050110	71308	729	AIR	3.7934	5014.57	23.33	23.38	662.243	758.038	371.488	174.108	-0.271	+0.135	0.32	0	376.62	
20050110	71308	729	AIR	3.7934	5014.57	23.38	23.38	662.224	758.038	371.468	174.108	-0.271	+0.135	0.32	0	376.55	
20050111	71370	730	AIR	3.7934	5014.57	23.31	23.36	687.982	762.565	371.464	174.092	-0.271	+0.135	0.31	0	406.96	
20050111	71370	730	AIR	3.7934	5014.57	23.31	23.36	687.929	762.565	371.435	174.092	-0.271	+0.135	0.31	0	406.93	
20050111	71370	731	AIR	3.7934	5014.57	23.07	23.31	686.796	760.810	371.460	174.202	-0.271	+0.135	0.31	0	407.00	
20050111	71370	731	AIR	3.7934	5014.57	23.24	23.31	686.852	760.810	371.436	174.202	-0.271	+0.135	0.31	0	406.86	
20050112	66625	732	AIR	3.7934	5014.57	23.31	23.11	639.112	760.671	371.474	174.133	-0.271	+0.135	0.29	0	344.75	
20050112	66625	732	AIR	3.7934	5014.57	23.35	23.11	639.201	760.671	371.454	174.133	-0.271	+0.135	0.29	0	344.84	
20050113	66625	733	AIR	3.7934	5014.57	22.94	23.33	640.354	764.440	371.476	174.084	-0.271	+0.135	0.29	0	344.83	
20050113	66625	733	AIR	3.7934	5014.57	22.96	23.33	640.377	764.440	371.442	174.084	-0.271	+0.135	0.29	0	344.88	
20050113	71479	734	AIR	3.7934	5014.57	23.02	22.94	726.552	766.312	371.522	174.064	-0.271	+0.135	0.30	0	453.57	
20050113	71479	734	AIR	3.7934	5014.57	23.13	22.94	726.754	766.312	371.518	174.064	-0.271	+0.135	0.30	0	453.65	
20050114	71479	735	AIR	3.7934	5014.57	23.09	23.07	726.123	765.783	371.567	174.207	-0.271	+0.135	0.30	0	453.57	
20050114	71479	735	AIR	3.7934	5014.57	23.14	23.07	726.289	765.783	371.524	174.207	-0.271	+0.135	0.30	0	453.76	
20050203	66638	736	AIR	3.7934	5014.57	23.31	23.44	643.002	780.551	371.406	174.202	-0.271	+0.135	0.31	0	338.80	
20050203	66638	736	AIR	3.7934	5014.57	23.40	23.44	643.066	780.551	371.406	174.202	-0.271	+0.135	0.31	0	338.77	
20050204	66638	737	AIR	3.7934	5014.57	23.99	23.35	637.936	767.393	371.442	174.110	-0.271	+0.135	0.31	0	338.81	
20050204	66638	737	AIR	3.7934	5014.57	24.08	23.35	637.944	767.393	371.407	174.110	-0.271	+0.135	0.31	0	338.75	
20050204	71341	738	AIR	3.7934	5014.57	24.27	24.03	623.666	765.254	371.414	174.136	-0.271	+0.135	0.31	0	322.27	
20050204	71341	738	AIR	3.7934	5014.57	24.32	24.03	623.758	765.254	371.433	174.136	-0.271	+0.135	0.31	0	322.30	
20050208	71341	739	AIR	3.7934	5014.57	24.08	23.89	623.720	765.408	371.432	174.152	-0.271	+0.135	0.31	0	322.30	
20050208	71341	739	AIR	3.7934	5014.57	24.07	23.89	623.657	765.408	371.408	174.152	-0.271	+0.135	0.31	0	322.26	
20050208	67615	740	AIR	3.7934	5014.57	23.90	24.07	764.213	763.905	371.432	174.086	-0.271	+0.135	0.30	0	504.50	
20050208	67615	740	AIR	3.7934	5014.57	24.01	24.07	764.366	763.905	371.400	174.086	-0.271	+0.135	0.30	0	504.54	
20050209	67615	741	AIR	3.7934	5014.57	23.74	23.91	764.780	764.902	371.427	174.148	-0.271	+0.135	0.30	0	504.44	
20050209	67615	741	AIR	3.7934	5014.57	23.78	23.91	764.786	764.902	371.404	174.148	-0.271	+0.135	0.30	0	504.40	
20050210	71251	742	AIR	3.7934	5014.57	23.60	23.77	538.430	765.300	371.447	174.188	-0.271	+0.135	0.34	0	213.27	
20050210	71251	742	AIR	3.7934	5014.57	23.63	23.77	538.424	765.300	371.409	174.188	-0.271	+0.135	0.34	0	213.29	
20050210	71251	743	AIR	3.7934	5014.57	23.91	23.62	537.688	762.094	371.439	174.125	-0.271	+0.135	0.34	0	213.12	Mercury made premature contact with pointer
20050211	71251	743	AIR	3.7934	5014.57	23.50	23.62	537.520	762.094	371.420	174.125	-0.271	+0.135	0.34	0	213.24	Mercury made premature contact with pointer
20050211	71251	743	AIR	3.7934	5014.57	23.52	23.62	537.500	762.094	371.404	174.125	-0.271	+0.135	0.34	0	213.22	
20050211	34819	744	AIR	3.7934	5014.57	23.71	23.96	567.398	761.517	371.425	174.147	-0.271	+0.135	0.24	0	252.24	
20050211	34819	744	AIR	3.7934	5014.57	23.73	23.96	567.490	761.517	371.410	174.147	-0.271	+0.135	0.24	0	252.36	
20050215	34819	745	AIR	3.7934	5014.57	23.86	23.81	569.300	766.524	371.410	174.163	-0.271	+0.135	0.24	0	252.29	
20050215	34819	745	AIR	3.7934	5014.57	23.86	23.81	569.189	766.524	371.412	174.163	-0.271	+0.135	0.24	0	252.15	Mercury made premature contact with pointer
20050215	34819	745	AIR	3.7934	5014.57	23.88	23.81	569.268	766.524	371.422	174.163	-0.271	+0.135	0.24	0	252.22	Mercury made premature contact with pointer
20050215	71286	746	AIR	3.7934	5014.57	23.92	23.86	603.015	763.638	371.430	174.165	-0.271	+0.135	0.32	0	296.78	
20050215	71286	746	AIR	3.7934	5014.57	23.97	23.86	603.084	763.638	371.376	174.165	-0.271	+0.135	0.32	0	296.88	
20050216	71286	747	AIR	3.7934	5014.57	24.03	23.94	603.030	763.687	371.432	174.158	-0.271	+0.135	0.32	0	296.73	
20050216	71286	747	AIR	3.7934	5014.57	24.09	23.94	603.116	763.687	371.411	174.158	-0.271	+0.135	0.32	0	296.81	
20050217	39272	748	N2	3.7934	5014.57	24.06	24.05	653.319	765.569	371.396	174.224	-0.271	+0.135	0.00	0	360.83	
20050217	39272	748	N2	3.7934	5014.57	24.05	24.05	653.274	765.569	371.400	174.224	-0.271	+0.135	0.00	0	360.78	
20050217	39272	749	N2	3.7934	5014.57	24.03	24.06	652.084	762.990	371.429	174.162	-0.271	+0.135	0.00	0	360.79	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 30/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
20050217	39272	749	N2	3.7934	5014.57	24.09	24.06	652.122	762.990	371.404	174.162	-0.271	+0.135	0.00	0	360.79	
20050218	1540	750	N2	3.7934	5014.57	24.39	24.06	666.770	760.496	371.426	174.201	-0.271	+0.135	0.00	0	380.88	
20050218	1540	750	N2	3.7934	5014.57	24.35	24.06	666.704	760.496	371.410	174.201	-0.271	+0.135	0.00	0	380.86	
20050317	1540	751	N2	3.7934	5014.57	23.47	23.95	666.292	761.316	371.501	174.219	-0.271	+0.135	0.00	0	380.74	
20050317	1540	751	N2	3.7934	5014.57	23.53	23.95	666.454	761.316	371.476	174.219	-0.271	+0.135	0.00	0	380.90	Mercury made premature contact with pointer
20050318	35299	752	N2	3.7934	5014.57	23.41	23.50	694.857	763.839	371.472	174.208	-0.271	+0.135	0.00	0	415.41	
20050318	35299	752	N2	3.7934	5014.57	23.45	23.50	694.901	763.839	371.461	174.208	-0.271	+0.135	0.00	0	415.43	
20050323	35299	753	N2	3.7934	5014.57	23.41	23.49	695.134	764.439	371.464	174.171	-0.271	+0.135	0.00	0	415.32	
20050323	35299	753	N2	3.7934	5014.57	23.46	23.49	695.176	764.439	371.456	174.171	-0.271	+0.135	0.00	0	415.31	
20050324	39256	754	N2	3.7934	5014.57	23.38	23.43	642.464	766.834	371.484	174.110	-0.271	+0.135	0.00	0	346.05	
20050324	39256	754	N2	3.7934	5014.57	23.44	23.43	642.536	766.834	371.454	174.110	-0.271	+0.135	0.00	0	346.11	
20050325	39256	755	N2	3.7934	5014.57	23.45	23.41	642.753	767.038	371.488	174.179	-0.271	+0.135	0.00	0	346.23	
20050325	39256	755	N2	3.7934	5014.57	23.48	23.41	642.728	767.038	371.451	174.179	-0.271	+0.135	0.00	0	346.20	
20050325	39239	756	N2	3.7934	5014.57	23.38	23.47	631.188	764.485	371.495	174.116	-0.271	+0.135	0.00	0	332.97	
20050325	39239	756	N2	3.7934	5014.57	23.43	23.47	631.220	764.485	371.467	174.116	-0.271	+0.135	0.00	0	332.99	
20050329	39239	757	N2	3.7934	5014.57	23.40	23.80	630.735	764.200	371.484	174.182	-0.271	+0.135	0.00	0	332.96	
20050329	39239	757	N2	3.7934	5014.57	23.45	23.80	630.765	764.200	371.468	174.182	-0.271	+0.135	0.00	0	332.96	
20050330	2408	758	N2	3.7934	5014.57	23.54	23.42	526.112	766.981	371.526	174.220	-0.271	+0.135	0.00	0	196.98	
20050330	2408	758	N2	3.7934	5014.57	23.60	23.42	526.066	766.981	371.475	174.220	-0.271	+0.135	0.00	0	196.94	
20050330	2408	759	N2	3.7934	5014.57	23.66	23.57	525.387	764.558	371.510	174.207	-0.271	+0.135	0.00	0	196.89	
20050330	2408	759	N2	3.7934	5014.57	23.74	23.57	525.417	764.558	371.453	174.207	-0.271	+0.135	0.00	0	196.95	
20050331	35316	760	N2	3.7934	5014.57	23.17	23.70	740.356	766.230	371.484	174.154	-0.271	+0.135	0.00	0	472.83	
20050331	35316	760	N2	3.7934	5014.57	23.21	23.70	740.493	766.230	371.455	174.154	-0.271	+0.135	0.00	0	472.97	
20050331	35316	761	N2	3.7934	5014.57	23.34	23.18	742.340	767.891	371.470	174.127	-0.271	+0.135	0.00	0	472.88	
20050401	35316	761	N2	3.7934	5014.57	23.49	23.18	742.729	767.891	371.472	174.127	-0.271	+0.135	0.00	0	473.12	
20050401	6071	762	N2	3.7934	5014.57	23.36	23.43	615.301	767.870	371.500	174.110	-0.271	+0.135	0.00	0	310.73	
20050401	6071	762	N2	3.7934	5014.57	23.43	23.43	615.351	767.870	371.468	174.110	-0.271	+0.135	0.00	0	310.76	
20050503	6071	763	N2	3.7934	5014.57	23.80	23.84	613.846	764.569	371.490	174.207	-0.271	+0.135	0.00	0	310.63	
20050503	6071	763	N2	3.7934	5014.57	23.85	23.84	613.889	764.569	371.424	174.207	-0.271	+0.135	0.00	0	310.71	
20050504	7366	764	N2	3.7934	5014.57	23.97	23.83	587.945	765.524	371.494	174.291	-0.271	+0.135	0.00	0	276.75	
20050504	7366	764	N2	3.7934	5014.57	24.00	23.83	587.920	765.524	371.440	174.291	-0.271	+0.135	0.00	0	276.76	
20050504	7366	765	N2	3.7934	5014.57	23.96	24.00	587.386	764.491	371.470	174.222	-0.271	+0.135	0.00	0	276.69	
20050504	7366	765	N2	3.7934	5014.57	23.98	24.00	587.400	764.491	371.449	174.222	-0.271	+0.135	0.00	0	276.72	
20050505	4274	766	N2	3.7934	5014.57	23.86	23.97	561.674	765.035	371.478	174.270	-0.271	+0.135	0.00	0	243.51	
20050505	4274	766	N2	3.7934	5014.57	23.92	23.97	561.674	765.035	371.460	174.270	-0.271	+0.135	0.00	0	243.48	Mercury made premature contact with pointer
20050506	4274	767	N2	3.7934	5014.57	23.97	23.87	561.636	764.453	371.483	174.154	-0.271	+0.135	0.00	0	243.46	
20050506	4274	767	N2	3.7934	5014.57	23.97	23.87	561.584	764.453	371.442	174.154	-0.271	+0.135	0.00	0	243.45	
20050506	4296	768	N2	3.7934	5014.57	23.81	23.97	621.232	763.605	371.482	174.170	-0.271	+0.135	0.00	0	320.77	
20050506	4296	768	N2	3.7934	5014.57	23.84	23.97	621.254	763.605	371.444	174.170	-0.271	+0.135	0.00	0	320.81	
20050509	4296	769	N2	3.7934	5014.57	23.92	23.83	623.238	767.870	371.466	174.173	-0.271	+0.135	0.00	0	320.77	
20050509	4296	769	N2	3.7934	5014.57	24.01	23.83	623.254	767.870	371.436	174.173	-0.271	+0.135	0.00	0	320.72	
20050510	6078	770	N2	3.7934	5014.57	23.80	23.96	613.746	764.049	371.458	174.214	-0.271	+0.135	0.00	0	310.95	
20050510	6078	770	N2	3.7934	5014.57	23.83	23.96	613.752	764.049	371.442	174.214	-0.271	+0.135	0.00	0	310.94	
20050511	2399	771	N2	3.7934	5014.57	23.81	23.82	624.722	765.358	371.450	174.195	-0.271	+0.135	0.00	0	324.18	
20050511	2399	771	N2	3.7934	5014.57	23.83	23.82	624.696	765.358	371.444	174.195	-0.271	+0.135	0.00	0	324.13	
20050511	6078	772	N2	3.7934	5014.57	23.89	23.82	613.528	763.080	371.451	174.178	-0.271	+0.135	0.00	0	310.92	
20050511	6078	772	N2	3.7934	5014.57	23.94	23.82	613.570	763.080	371.438	174.178	-0.271	+0.135	0.00	0	310.93	
20050512	2399	773	N2	3.7934	5014.57	23.92	23.92	623.780	763.252	371.478	174.246	-0.271	+0.135	0.00	0	324.11	
20050512	2399	773	N2	3.7934	5014.57	23.96	23.92	623.802	763.252	371.446	174.246	-0.271	+0.135	0.00	0	324.13	
20050513	18372	774	AIR	3.7934	5014.57	24.18	23.94	664.036	762.374	371.477	174.220	-0.271	+0.135	0.31	0	375.86	
20050513	18372	774	AIR	3.7934	5014.57	24.18	23.94	663.965	762.374	371.440	174.220	-0.271	+0.135	0.31	0	375.81	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 31/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
20050513	18372	775	AIR	3.7934	5014.57	23.96	24.18	664.072	763.453	371.494	174.192	-0.271	+0.135	0.31	0	375.79	Mercury made premature contact with pointer
20050513	18372	775	AIR	3.7934	5014.57	24.04	24.18	664.169	763.453	371.472	174.192	-0.271	+0.135	0.31	0	375.83	Mercury made premature contact with pointer
20050608	17438	776	AIR	3.7934	5014.57	24.77	24.37	799.454	762.003	371.489	174.196	-0.271	+0.135	0.31	0	550.62	
20050608	17438	776	AIR	3.7934	5014.57	24.97	24.37	799.656	762.003	371.459	174.196	-0.271	+0.135	0.31	0	550.53	
20050608	17438	777	AIR	3.7934	5014.57	25.67	24.81	799.784	761.801	371.466	174.232	-0.271	+0.135	0.31	0	550.39	
20050608	17438	777	AIR	3.7934	5014.57	25.91	24.81	800.190	761.801	371.455	174.232	-0.271	+0.135	0.31	0	550.46	
20050609	17476	778	AIR	3.7934	5014.57	24.63	25.76	641.972	763.629	371.488	174.186	-0.271	+0.135	0.31	0	348.32	
20050609	17476	778	AIR	3.7934	5014.57	24.76	25.76	642.094	763.629	371.474	174.186	-0.271	+0.135	0.31	0	348.33	
20050610	17476	779	AIR	3.7934	5014.57	24.64	24.69	643.456	764.521	371.502	174.186	-0.271	+0.135	0.31	0	348.35	
20050610	17476	779	AIR	3.7934	5014.57	24.63	24.69	643.391	764.521	371.456	174.186	-0.271	+0.135	0.31	0	348.34	
20050610	20737	780	AIR	3.7934	5014.57	24.77	24.63	703.718	761.645	371.468	174.202	-0.271	+0.135	0.31	0	427.71	
20050610	20737	780	AIR	3.7934	5014.57	24.88	24.63	703.898	761.645	371.451	174.202	-0.271	+0.135	0.31	0	427.80	
20050614	20737	781	AIR	3.7934	5014.57	23.98	24.07	702.775	760.285	371.484	174.180	-0.271	+0.135	0.31	0	427.81	
20050614	20737	781	AIR	3.7934	5014.57	23.98	24.07	702.657	760.285	371.436	174.180	-0.271	+0.135	0.31	0	427.71	
20050614	71308	782	AIR	3.7934	5014.57	23.91	23.98	663.392	761.242	371.468	174.206	-0.271	+0.135	0.32	0	376.16	
20050614	71308	782	AIR	3.7934	5014.57	23.93	23.98	663.480	761.242	371.496	174.206	-0.271	+0.135	0.32	0	376.21	
20050615	66696	783	AIR	3.7934	5014.57	23.94	23.96	651.022	760.700	371.486	174.228	-0.271	+0.135	0.31	0	360.43	
20050616	66696	783	AIR	3.7934	5014.57	23.97	23.96	651.069	760.700	371.467	174.228	-0.271	+0.135	0.31	0	360.48	
20050616	71370	784	AIR	3.7934	5014.57	23.97	23.96	687.374	761.763	371.458	174.132	-0.271	+0.135	0.31	0	406.67	
20050616	71370	784	AIR	3.7934	5014.57	24.00	23.96	687.388	761.763	371.440	174.132	-0.271	+0.135	0.31	0	406.67	
20050617	18067	785	AIR	3.7934	5014.57	24.02	23.99	646.914	765.539	371.475	174.220	-0.271	+0.135	0.31	0	352.15	
20050617	18067	785	AIR	3.7934	5014.57	24.01	23.99	646.876	765.539	371.450	174.220	-0.271	+0.135	0.31	0	352.15	
20050617	18067	786	AIR	3.7934	5014.57	23.93	24.02	645.890	763.640	371.462	174.172	-0.271	+0.135	0.31	0	352.11	
20050617	18067	786	AIR	3.7934	5014.57	23.97	24.02	645.916	763.640	371.472	174.172	-0.271	+0.135	0.31	0	352.08	
20050707	17563	787	AIR	3.7934	5014.57	24.52	24.38	674.499	763.724	371.499	174.243	-0.271	+0.135	0.32	0	388.57	
20050707	17563	787	AIR	3.7934	5014.57	24.55	24.38	674.437	763.724	371.470	174.243	-0.271	+0.135	0.32	0	388.48	
20050707	17563	788	AIR	3.7934	5014.57	24.41	24.53	673.440	762.317	371.466	174.175	-0.271	+0.135	0.32	0	388.49	
20050707	17563	788	AIR	3.7934	5014.57	24.41	24.53	673.419	762.317	371.450	174.175	-0.271	+0.135	0.32	0	388.48	
20050708	17491	789	AIR	3.7934	5014.57	24.36	24.41	684.621	762.929	371.482	174.208	-0.271	+0.135	0.32	0	402.41	
20050708	17491	789	AIR	3.7934	5014.57	24.38	24.41	684.621	762.929	371.448	174.208	-0.271	+0.135	0.32	0	402.43	
20050708	17491	790	AIR	3.7934	5014.57	24.33	24.36	684.802	763.291	371.494	174.168	-0.271	+0.135	0.32	0	402.33	
20050708	17491	790	AIR	3.7934	5014.57	24.38	24.36	684.870	763.291	371.478	174.168	-0.271	+0.135	0.32	0	402.36	
20050712	17440	791	AIR	3.7934	5014.57	24.42	24.29	744.551	762.808	371.452	174.190	-0.271	+0.135	0.32	0	479.56	
20050712	17440	791	AIR	3.7934	5014.57	24.35	24.29	744.400	762.808	371.468	174.190	-0.271	+0.135	0.32	0	479.47	
20050713	17440	792	AIR	3.7934	5014.57	24.38	24.41	744.231	762.415	371.478	174.184	-0.271	+0.135	0.32	0	479.70	
20050713	17440	792	AIR	3.7934	5014.57	24.29	24.41	744.014	762.415	371.440	174.184	-0.271	+0.135	0.32	0	479.63	
20050713	18470	793	AIR	3.7934	5014.57	24.02	24.35	653.695	764.975	371.462	174.213	-0.271	+0.135	0.31	0	361.67	
20050714	18470	793	AIR	3.7934	5014.57	23.94	24.35	653.702	764.975	371.471	174.213	-0.271	+0.135	0.31	0	361.77	
20050714	18470	794	AIR	3.7934	5014.57	23.88	24.02	653.480	764.091	371.440	174.162	-0.271	+0.135	0.31	0	361.69	
20050714	18470	794	AIR	3.7934	5014.57	23.89	24.02	653.503	764.091	371.436	174.162	-0.271	+0.135	0.31	0	361.71	
20050715	67615	795	AIR	3.7934	5014.57	24.06	23.88	764.734	764.118	371.484	174.162	-0.271	+0.135	0.30	0	504.36	
20050715	67615	795	AIR	3.7934	5014.57	24.06	23.88	764.640	764.118	371.406	174.162	-0.271	+0.135	0.30	0	504.33	
20050715	66638	796	AIR	3.7934	5014.57	23.96	24.06	635.249	763.308	371.446	174.188	-0.271	+0.135	0.31	0	338.64	
20050715	66638	796	AIR	3.7934	5014.57	24.00	24.06	635.276	763.308	371.443	174.188	-0.271	+0.135	0.31	0	338.63	
20050719	71479	797	AIR	3.7934	5014.57	24.12	24.07	723.684	761.630	371.460	174.222	-0.271	+0.135	0.30	0	453.72	
20050719	71479	797	AIR	3.7934	5014.57	24.12	24.07	723.618	761.630	371.429	174.222	-0.271	+0.135	0.30	0	453.67	
20050719	66625	798	AIR	3.7934	5014.57	24.07	24.12	639.390	761.974	371.434	174.152	-0.271	+0.135	0.29	0	344.71	
20050719	66625	798	AIR	3.7934	5014.57	24.12	24.12	639.374	761.974	371.444	174.152	-0.271	+0.135	0.29	0	344.61	Mercury made premature contact with pointer
20050720	66625	798	AIR	3.7934	5014.57	24.15	24.12	639.483	761.974	371.484	174.152	-0.271	+0.135	0.29	0	344.66	
20050720	34819	799	AIR	3.7934	5014.57	23.97	24.09	567.683	762.140	371.490	174.150	-0.271	+0.135	0.24	0	252.14	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 32/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
20050720	34819	799	AIR	3.7934	5014.57	24.02	24.09	567.675	762.140	371.419	174.150	-0.271	+0.135	0.24	0	252.17	
20050721	71341	800	AIR	3.7934	5014.57	24.01	23.99	623.269	764.922	371.468	174.172	-0.271	+0.135	0.31	0	322.14	
20050721	71341	800	AIR	3.7934	5014.57	24.00	23.99	623.232	764.922	371.454	174.172	-0.271	+0.135	0.31	0	322.13	
20050809	71286	801	AIR	3.7934	5014.57	24.01	23.77	604.333	766.590	371.478	174.197	-0.271	+0.135	0.32	0	296.75	
20050809	71286	801	AIR	3.7934	5014.57	23.96	23.77	604.216	766.590	371.454	174.197	-0.271	+0.135	0.32	0	296.68	
20050809	71251	802	AIR	3.7934	5014.57	24.00	23.97	538.030	764.032	371.469	174.152	-0.271	+0.135	0.34	0	213.02	
20050809	71251	802	AIR	3.7934	5014.57	24.08	23.97	538.040	764.032	371.438	174.152	-0.271	+0.135	0.34	0	213.02	
20050810	71308	803	AIR	3.7934	5014.57	23.98	24.04	665.492	765.561	371.492	174.227	-0.271	+0.135	0.32	0	376.07	
20050810	71308	803	AIR	3.7934	5014.57	24.01	24.04	665.466	765.561	371.434	174.227	-0.271	+0.135	0.32	0	376.07	
20050811	71370	804	AIR	3.7934	5014.57	23.92	24.01	691.763	770.222	371.474	174.228	-0.271	+0.135	0.31	0	406.68	
20050811	71370	804	AIR	3.7934	5014.57	23.94	24.01	691.755	770.222	371.440	174.228	-0.271	+0.135	0.31	0	406.68	
20050812	66696	805	AIR	3.7934	5014.57	24.18	23.93	653.653	765.759	371.480	174.172	-0.271	+0.135	0.31	0	360.35	
20050812	66696	805	AIR	3.7934	5014.57	24.18	23.93	653.607	765.759	371.432	174.172	-0.271	+0.135	0.31	0	360.35	
20050812	67615	806	AIR	3.7934	5014.57	24.03	24.18	765.155	765.629	371.461	174.232	-0.271	+0.135	0.30	0	504.29	
20050812	67615	806	AIR	3.7934	5014.57	24.09	24.18	765.258	765.629	371.453	174.232	-0.271	+0.135	0.30	0	504.32	
20050815	66638	807	AIR	3.7934	5014.57	23.98	23.98	636.766	766.638	371.454	174.182	-0.271	+0.135	0.31	0	338.54	
20050815	66638	807	AIR	3.7934	5014.57	23.98	23.98	636.742	766.638	371.435	174.182	-0.271	+0.135	0.31	0	338.53	
20050816	71479	808	AIR	3.7934	5014.57	23.94	23.98	724.984	764.243	371.464	174.154	-0.271	+0.135	0.30	0	453.47	
20050816	71479	808	AIR	3.7934	5014.57	23.98	23.98	725.028	764.243	371.435	174.154	-0.271	+0.135	0.30	0	453.50	
20050817	66625	809	AIR	3.7934	5014.57	24.20	23.96	641.404	765.868	371.484	174.170	-0.271	+0.135	0.29	0	344.61	
20050817	66625	809	AIR	3.7934	5014.57	24.20	23.96	641.347	765.868	371.457	174.170	-0.271	+0.135	0.29	0	344.57	
20050817	34819	810	AIR	3.7934	5014.57	23.98	24.20	568.363	764.532	371.475	174.232	-0.271	+0.135	0.24	0	252.13	
20050817	34819	810	AIR	3.7934	5014.57	24.09	24.20	568.367	764.532	371.432	174.232	-0.271	+0.135	0.24	0	252.09	Mercury made premature contact with pointer
20050818	71341	811	AIR	3.7934	5014.57	23.98	24.01	622.577	763.549	371.474	174.217	-0.271	+0.135	0.31	0	322.08	
20050818	71341	811	AIR	3.7934	5014.57	23.99	24.01	622.578	763.549	371.442	174.217	-0.271	+0.135	0.31	0	322.11	
20050819	71286	812	AIR	3.7934	5014.57	24.43	23.98	603.354	763.831	371.464	174.201	-0.271	+0.135	0.32	0	296.68	
20050819	71286	812	AIR	3.7934	5014.57	24.41	23.98	603.286	763.831	371.462	174.201	-0.271	+0.135	0.32	0	296.61	
20050819	71251	813	AIR	3.7934	5014.57	24.05	24.42	537.795	763.844	371.466	174.222	-0.271	+0.135	0.34	0	213.12	Mercury made premature contact with pointer
20050819	71251	813	AIR	3.7934	5014.57	24.08	24.42	537.798	763.844	371.475	174.222	-0.271	+0.135	0.34	0	213.09	
20050907	1661	814	AIR	3.7934	5014.58	23.83	23.93	668.550	765.269	371.486	174.237	-0.271	+0.135	0.31	0	380.27	
20050907	1661	814	AIR	3.7934	5014.58	23.86	23.93	668.572	765.269	371.478	174.237	-0.271	+0.135	0.31	0	380.26	
20050909	1649	815	AIR	3.7934	5014.58	23.83	23.93	661.730	767.882	371.468	174.230	-0.271	+0.135	0.31	0	369.89	
20050909	1649	815	AIR	3.7934	5014.58	23.87	23.93	661.773	767.882	371.518	174.230	-0.271	+0.135	0.31	0	369.82	
20050921	1649	816	AIR	3.7934	5014.58	23.74	23.71	661.700	767.123	371.447	174.195	-0.271	+0.135	0.31	0	370.16	
20050921	1649	816	AIR	3.7934	5014.58	23.75	23.71	661.606	767.123	371.421	174.195	-0.271	+0.135	0.31	0	370.06	
20050922	1653	817	AIR	3.7934	5014.58	23.80	23.74	669.832	766.875	371.474	174.198	-0.271	+0.135	0.31	0	380.65	
20050922	1653	817	AIR	3.7934	5014.58	23.81	23.74	669.791	766.875	371.454	174.198	-0.271	+0.135	0.31	0	380.61	
20050922	1653	818	AIR	3.7934	5014.58	23.78	23.80	668.426	764.409	371.459	174.187	-0.271	+0.135	0.31	0	380.56	
20050923	1653	818	AIR	3.7934	5014.58	24.06	23.80	668.766	764.409	371.458	174.187	-0.271	+0.135	0.31	0	380.61	
20050923	1661	819	AIR	3.7934	5014.58	23.83	23.80	667.677	763.360	371.456	174.196	-0.271	+0.135	0.31	0	380.21	
20050923	1661	819	AIR	3.7934	5014.58	23.89	23.80	667.766	763.360	371.456	174.196	-0.271	+0.135	0.31	0	380.24	
20051012	1661	820	AIR	3.7934	5014.58	24.72	24.43	669.871	767.017	371.477	174.278	-0.271	+0.135	0.31	0	380.34	
20051012	1661	820	AIR	3.7934	5014.58	24.72	24.43	669.815	767.017	371.452	174.278	-0.271	+0.135	0.31	0	380.30	
20051012	6873	821	AIR	3.7934	5014.58	24.77	24.72	653.644	766.391	371.494	174.180	-0.271	+0.135	0.31	0	360.19	
20051012	6873	821	AIR	3.7934	5014.58	24.58	24.72	653.458	766.391	371.447	174.180	-0.271	+0.135	0.31	0	360.25	
20051013	6873	822	AIR	3.7934	5014.58	23.61	24.71	652.089	765.643	371.494	174.208	-0.271	+0.135	0.31	0	360.14	
20051013	6873	822	AIR	3.7934	5014.58	23.67	24.71	652.138	765.643	371.434	174.208	-0.271	+0.135	0.31	0	360.20	
20051014	1662	823	AIR	3.7934	5014.58	23.79	23.63	647.012	767.765	371.464	174.192	-0.271	+0.135	0.31	0	350.79	
20051014	1662	823	AIR	3.7934	5014.58	23.79	23.63	646.908	767.765	371.440	174.192	-0.271	+0.135	0.31	0	350.69	
20051014	1662	824	AIR	3.7934	5014.58	23.71	23.79	644.875	763.657	371.486	174.196	-0.271	+0.135	0.31	0	350.76	
20051014	1662	824	AIR	3.7934	5014.58	23.80	23.79	645.029	763.657	371.436	174.196	-0.271	+0.135	0.31	0	350.91	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 33/34

*Temperature corrected for thermometer drift

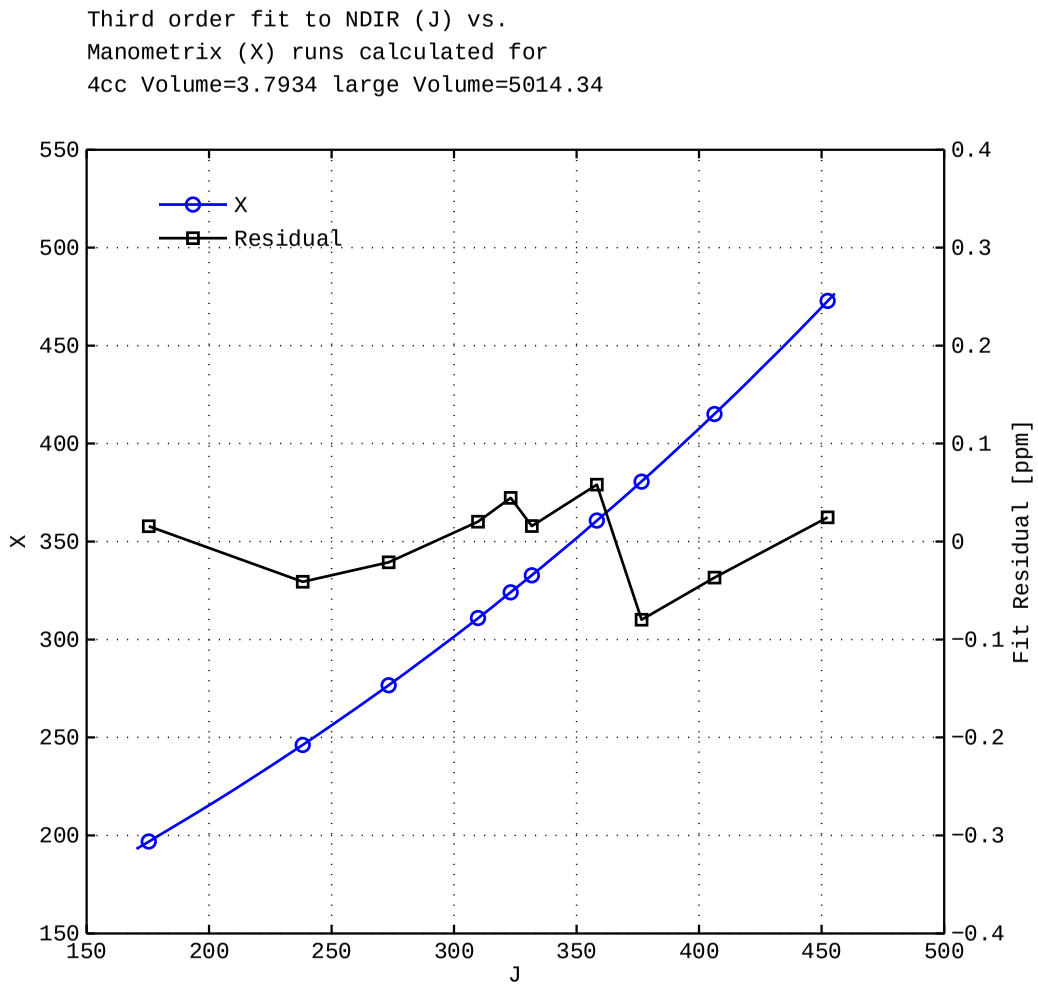
Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 °C*	Temp Tot °C*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
20051018	1658	825	AIR	3.7934	5014.58	23.70	23.82	685.174	764.911	371.462	174.180	-0.271	+0.135	0.31	0	401.89	
20051018	1658	825	AIR	3.7934	5014.58	23.72	23.82	685.170	764.911	371.422	174.180	-0.271	+0.135	0.31	0	401.91	
20051019	1658	826	AIR	3.7934	5014.58	23.85	23.70	686.737	767.200	371.475	174.205	-0.271	+0.135	0.31	0	401.96	
20051019	1658	826	AIR	3.7934	5014.58	23.86	23.70	686.708	767.200	371.456	174.205	-0.271	+0.135	0.31	0	401.93	
20051020	1655	827	AIR	3.7934	5014.58	23.88	23.96	705.630	768.797	371.451	174.180	-0.271	+0.135	0.31	0	425.35	
20051020	1655	827	AIR	3.7934	5014.58	23.90	23.96	705.688	768.797	371.424	174.180	-0.271	+0.135	0.31	0	425.43	
20051021	1661	828	AIR	3.7934	5014.58	23.85	23.89	670.392	768.705	371.462	174.208	-0.271	+0.135	0.31	0	380.35	
20051021	1661	828	AIR	3.7934	5014.58	23.90	23.89	670.429	768.705	371.477	174.208	-0.271	+0.135	0.31	0	380.31	
20051110	1661	829	AIR	3.7934	5014.58	24.13	24.05	670.020	767.371	371.497	174.194	-0.271	+0.135	0.31	0	380.51	
20051110	1661	829	AIR	3.7934	5014.58	24.13	24.05	669.993	767.371	371.466	174.194	-0.271	+0.135	0.31	0	380.52	
20051122	1655	830	AIR	3.7934	5014.58	23.67	23.74	707.284	771.376	371.444	174.246	-0.271	+0.135	0.31	0	425.66	
20051122	1655	830	AIR	3.7934	5014.58	23.82	23.74	707.366	771.376	371.434	174.246	-0.271	+0.135	0.31	0	425.55	
20051122	1661	831	AIR	3.7934	5014.58	24.09	23.71	670.658	768.259	371.447	174.163	-0.271	+0.135	0.31	0	380.40	
20051122	1661	831	AIR	3.7934	5014.58	24.21	23.71	670.798	768.259	371.448	174.163	-0.271	+0.135	0.31	0	380.41	
20051213	1661	832	AIR	3.7934	5014.58	23.53	23.39	671.190	769.906	371.450	174.167	-0.271	+0.135	0.31	0	380.35	
20051213	1661	832	AIR	3.7934	5014.58	23.56	23.39	671.170	769.906	371.416	174.167	-0.271	+0.135	0.31	0	380.32	
20051214	1659	833	AIR	3.7934	5014.58	23.42	23.55	638.802	769.817	371.431	174.183	-0.271	+0.135	0.31	0	339.51	
20051214	1659	833	AIR	3.7934	5014.58	23.47	23.55	638.813	769.817	371.418	174.183	-0.271	+0.135	0.31	0	339.48	
20051215	1659	834	AIR	3.7934	5014.58	23.46	23.45	641.228	774.867	371.460	174.250	-0.271	+0.135	0.31	0	339.56	
20051215	1659	834	AIR	3.7934	5014.58	23.47	23.45	641.194	774.867	371.405	174.250	-0.271	+0.135	0.31	0	339.57	
20051215	1654	835	AIR	3.7934	5014.58	23.46	23.46	623.121	768.284	371.442	174.200	-0.271	+0.135	0.31	0	320.20	
20051215	1654	835	AIR	3.7934	5014.58	23.54	23.46	623.182	768.284	371.442	174.200	-0.271	+0.135	0.31	0	320.19	
20051216	1654	836	AIR	3.7934	5014.58	23.30	23.49	622.503	767.234	371.425	174.188	-0.271	+0.135	0.31	0	320.21	
20051216	1654	836	AIR	3.7934	5014.58	23.34	23.49	622.566	767.234	371.408	174.188	-0.271	+0.135	0.31	0	320.27	
20060109	1661	837	AIR	3.7934	5014.58	23.74	23.55	672.648	772.664	371.475	174.195	-0.271	+0.135	0.31	0	380.36	
20060109	1661	837	AIR	3.7934	5014.58	23.74	23.55	672.670	772.664	371.428	174.195	-0.271	+0.135	0.31	0	380.45	
20060110	1661	837	AIR	3.7934	5014.58	23.07	23.55	671.925	772.664	371.458	174.195	-0.271	+0.135	0.31	0	380.37	
20060110	1648	838	AIR	3.7934	5014.58	23.31	23.74	609.122	770.614	371.466	174.146	-0.271	+0.135	0.31	0	301.55	
20060110	1648	838	AIR	3.7934	5014.58	23.36	23.74	609.130	770.614	371.420	174.146	-0.271	+0.135	0.31	0	301.56	
20060111	1648	839	AIR	3.7934	5014.58	23.35	23.33	609.386	770.296	371.464	174.208	-0.271	+0.135	0.31	0	301.60	
20060111	1648	839	AIR	3.7934	5014.58	23.44	23.33	609.436	770.296	371.459	174.208	-0.271	+0.135	0.31	0	301.57	
20060424	1661	840	AIR	3.7934	5014.58	23.67	23.73	671.420	770.436	371.454	174.186	-0.271	+0.135	0.31	0	380.58	Mercury made premature contact with pointer
20060424	1661	840	AIR	3.7934	5014.58	23.74	23.73	671.506	770.436	371.472	174.186	-0.271	+0.135	0.31	0	380.57	
20060622	1661	841	AIR	3.7934	5014.59	24.50	24.22	669.588	766.353	371.450	174.188	-0.271	+0.135	0.31	0	380.40	
20060622	1661	841	AIR	3.7934	5014.59	24.41	24.22	669.474	766.353	371.426	174.188	-0.271	+0.135	0.31	0	380.40	
20060818	1661	841	AIR	3.7934	5014.59	24.66	24.22	669.860	766.353	371.451	174.188	-0.271	+0.135	0.31	0	380.53	
20060821	1653	842	AIR	3.7934	5014.59	23.69	23.89	669.332	766.410	371.416	174.169	-0.271	+0.135	0.31	0	380.72	
20060821	1653	842	AIR	3.7934	5014.59	23.80	23.89	669.440	766.410	371.428	174.169	-0.271	+0.135	0.31	0	380.69	
20060822	1658	843	AIR	3.7934	5014.59	23.60	23.71	685.820	766.085	371.457	174.196	-0.271	+0.135	0.31	0	401.93	
20060822	1658	843	AIR	3.7934	5014.59	23.66	23.71	685.856	766.085	371.416	174.196	-0.271	+0.135	0.31	0	401.94	
20060823	1661	844	AIR	3.7934	5014.59	23.80	23.64	669.569	766.638	371.441	174.222	-0.271	+0.135	0.31	0	380.39	
20060823	1661	844	AIR	3.7934	5014.59	23.80	23.64	669.540	766.638	371.450	174.222	-0.271	+0.135	0.31	0	380.34	Mercury made premature contact with pointer
20060925	1661	845	AIR	3.7934	5014.59	24.03	23.88	668.624	764.746	371.428	174.110	-0.271	+0.135	0.31	0	380.35	CO2 extract measured in ECMII first
20060925	1661	846	AIR	3.7934	5014.59	24.09	23.90	668.158	763.893	371.454	174.135	-0.271	+0.135	0.31	0	380.23	CO2 extract measured in ECMII first
20060926	1661	847	AIR	3.7934	5014.59	23.78	23.76	668.220	764.195	371.422	174.128	-0.271	+0.135	0.31	0	380.38	CO2 extract measured in ECMII first
20060927	1661	848	AIR	3.7934	5014.59	23.86	23.85	671.432	770.608	371.453	174.178	-0.271	+0.135	0.31	0	380.38	
20060927	1661	848	AIR	3.7934	5014.59	23.86	23.85	671.438	770.608	371.430	174.178	-0.271	+0.135	0.31	0	380.42	Mercury made premature contact with pointer
20061024	1661	849	AIR	3.7934	5014.59	24.13	24.44	667.624	763.693	371.454	174.165	-0.271	+0.135	0.31	0	380.37	
20061024	1661	849	AIR	3.7934	5014.59	24.13	24.44	667.644	763.693	371.446	174.165	-0.271	+0.135	0.31	0	380.40	
20061206	1661	850	AIR	3.7934	5014.59	22.07	22.51	671.832	772.360	371.458	174.137	-0.271	+0.135	0.31	0	380.36	

Table A7: Manometric Reference Gas Measurements: Original Data. Page 34/34

*Temperature corrected for thermometer drift

Date	Cyl	Run	Gas	Vol CO_2 cc	Vol Tot cc	Temp CO_2 ^oC*	Temp Tot ^oC*	HtVac CO_2 mm	HtVac Tot mm	HtSmp CO_2 mm	HtSmp Tot mm	MnCor CO_2 mm	MnCor Tot mm	N_2O ppm	Flg	CO_2 ppm	Comment
20061206	1661	850	AIR	3.7934	5014.59	22.16	22.51	671.874	772.360	371.427	174.137	-0.271	+0.135	0.31	0	380.33	
20070308	1661	851	AIR	3.7934	5014.59	24.19	24.19	646.047	720.085	371.472	174.114	-0.271	+0.135	0.31	0	380.26	Mercury made premature contact with pointer
20070308	1661	851	AIR	3.7934	5014.59	24.20	24.19	646.044	720.085	371.446	174.114	-0.271	+0.135	0.31	0	380.28	
20071114	1661	852	AIR	3.7934	5014.6	23.10	23.39	671.488	770.958	371.452	174.123	-0.271	+0.135	0.31	0	380.61	
20071114	1661	852	AIR	3.7934	5014.6	23.47	23.39	671.729	770.958	371.398	174.123	-0.271	+0.135	0.31	0	380.48	
20071115	6874	853	AIR	3.7934	5014.6	23.11	23.21	689.685	767.796	371.455	174.165	-0.271	+0.135	0.31	0	405.68	
20071115	6874	853	AIR	3.7934	5014.6	23.37	23.21	689.884	767.796	371.426	174.165	-0.271	+0.135	0.31	0	405.60	Mercury made premature contact with pointer-Hg "jumping"
20071115	6874	854	AIR	3.7934	5014.6	24.17	23.14	688.920	764.025	371.416	174.118	-0.271	+0.135	0.31	0	405.67	
20071116	6874	854	AIR	3.7934	5014.6	23.41	23.14	688.122	764.025	371.424	174.118	-0.271	+0.135	0.31	0	405.74	
20071119	1661	855	AIR	3.7934	5014.6	22.96	23.08	670.848	769.855	371.400	174.094	-0.271	+0.135	0.31	0	380.31	
20071119	1661	855	AIR	3.7934	5014.6	22.99	23.08	670.844	769.855	371.416	174.094	-0.271	+0.135	0.31	0	380.25	Mercury made premature contact with pointer
20080108	1661	856	AIR	3.7934	5014.6	21.93	22.43	669.285	767.987	371.454	174.118	-0.271	+0.135	0.31	10	379.98	Mercury made premature contact with pointer
20080108	1661	856	AIR	3.7934	5014.6	21.99	22.43	669.564	767.987	371.438	174.118	-0.271	+0.135	0.31	0	380.28	
20080108	1661	856	AIR	3.7934	5014.6	22.24	22.43	669.792	767.987	371.446	174.118	-0.271	+0.135	0.31	0	380.22	Mercury made premature contact with pointer
20080312	1661	857	AIR	3.7934	5014.6	24.84	25.49	675.230	779.876	371.412	174.081	-0.271	+0.135	0.31	0	380.19	
20080312	1661	857	AIR	3.7934	5014.6	24.65	25.49	675.084	779.876	371.386	174.081	-0.271	+0.135	0.31	0	380.30	
20080515	1661	858	AIR	3.7934	5014.61	23.03	22.56	670.910	768.906	371.434	174.124	-0.271	+0.135	0.31	10	380.17	Mercury made premature contact with pointer
20080515	1661	858	AIR	3.7934	5014.61	23.03	22.56	671.032	768.906	371.441	174.124	-0.271	+0.135	0.31	0	380.32	
20080515	1661	858	AIR	3.7934	5014.61	23.49	22.56	671.490	768.906	371.408	174.124	-0.271	+0.135	0.31	0	380.32	
20080721	1661	859	AIR	3.7934	5014.61	22.32	22.42	668.210	764.321	371.430	174.092	-0.271	+0.135	0.31	0	380.43	
20080721	1661	859	AIR	3.7934	5014.61	22.36	22.42	668.256	764.321	371.396	174.092	-0.271	+0.135	0.31	0	380.47	
20080917	1661	860	AIR	3.7934	5014.61	22.08	21.62	670.627	767.949	371.447	174.088	-0.271	+0.135	0.31	0	380.40	
20080917	1661	860	AIR	3.7934	5014.61	22.12	21.62	670.598	767.949	371.420	174.088	-0.271	+0.135	0.31	0	380.35	
20081118	1661	861	AIR	3.7934	5014.61	21.83	21.90	676.942	777.129	376.412	179.136	-0.271	+0.135	0.31	0	380.21	
20081118	1661	861	AIR	3.7934	5014.61	21.82	21.90	677.016	777.129	376.374	179.136	-0.271	+0.135	0.31	0	380.36	
20090122	1661	862	AIR	3.7934	5014.61	21.77	22.11	677.680	776.883	378.383	181.140	-0.271	+0.135	0.31	0	380.44	
20090122	1661	862	AIR	3.7934	5014.61	21.87	22.11	677.682	776.883	378.398	181.140	-0.271	+0.135	0.31	0	380.29	
20090319	1661	863	AIR	3.7934	5014.62	19.85	20.04	678.018	775.954	379.430	182.069	-0.271	+0.135	0.31	0	380.53	
20090320	1661	863	AIR	3.7934	5014.62	19.89	20.04	677.968	775.954	379.416	182.069	-0.271	+0.135	0.31	0	380.43	
20090519	1661	864	AIR	3.7934	5014.62	21.12	20.88	680.472	778.314	381.480	184.158	-0.271	+0.135	0.31	0	380.28	
20090519	1661	864	AIR	3.7934	5014.62	21.14	20.88	680.457	778.314	381.436	184.158	-0.271	+0.135	0.31	0	380.29	
20090921	1661	865	AIR	3.7934	5014.62	21.66	21.89	672.360	772.071	372.497	175.199	-0.271	+0.135	0.31	0	380.29	
20090921	1661	865	AIR	3.7934	5014.62	21.75	21.89	672.499	772.071	372.470	175.199	-0.271	+0.135	0.31	0	380.38	
20091210	1661	866	AIR	3.7934	5014.63	20.51	20.62	674.598	776.373	372.464	175.200	-0.271	+0.135	0.31	0	380.28	
20091210	1661	866	AIR	3.7934	5014.63	20.54	20.62	674.638	776.373	372.458	175.200	-0.271	+0.135	0.31	0	380.30	
20100209	1661	867	AIR	3.7934	5014.63	21.73	21.02	674.009	773.442	372.450	175.149	-0.271	+0.135	0.31	0	380.26	
20100209	1661	867	AIR	3.7934	5014.63	21.91	21.02	674.190	773.442	372.446	175.149	-0.271	+0.135	0.31	0	380.24	

18 Appendix B. Supplemental Figures

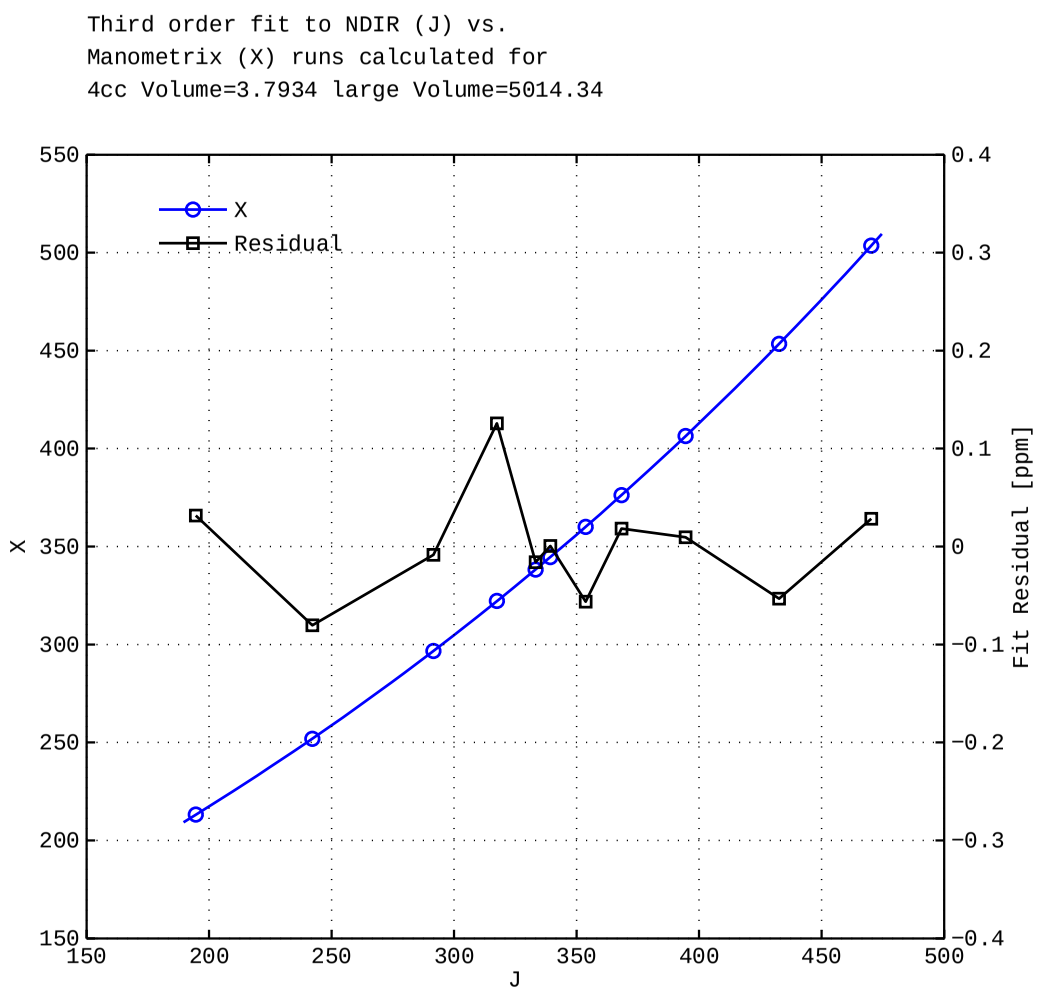


Cyl	J	X	Fit	Res
2408	175.366	196.864	196.848	+0.016
3753	238.238	246.178	246.219	−0.041
7366	273.293	276.673	276.694	−0.021
6078	309.768	310.908	310.888	+0.020
2399	323.104	324.106	324.061	+0.044
39239	331.712	332.778	332.763	+0.016
39272	358.253	360.662	360.604	+0.058
1540	376.498	380.579	380.659	−0.080
35299	406.295	415.055	415.092	−0.037
35316	452.471	472.821	472.796	+0.025
			Standard Deviation	0.043

Coefficients
+8.7122521e+01
+5.3715469e−01
+3.8352208e−04
+6.9205292e−07

Central Date: 29−Jul−1985

Figure B-1: Cubic fit of nitrogen primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1985 calibration period

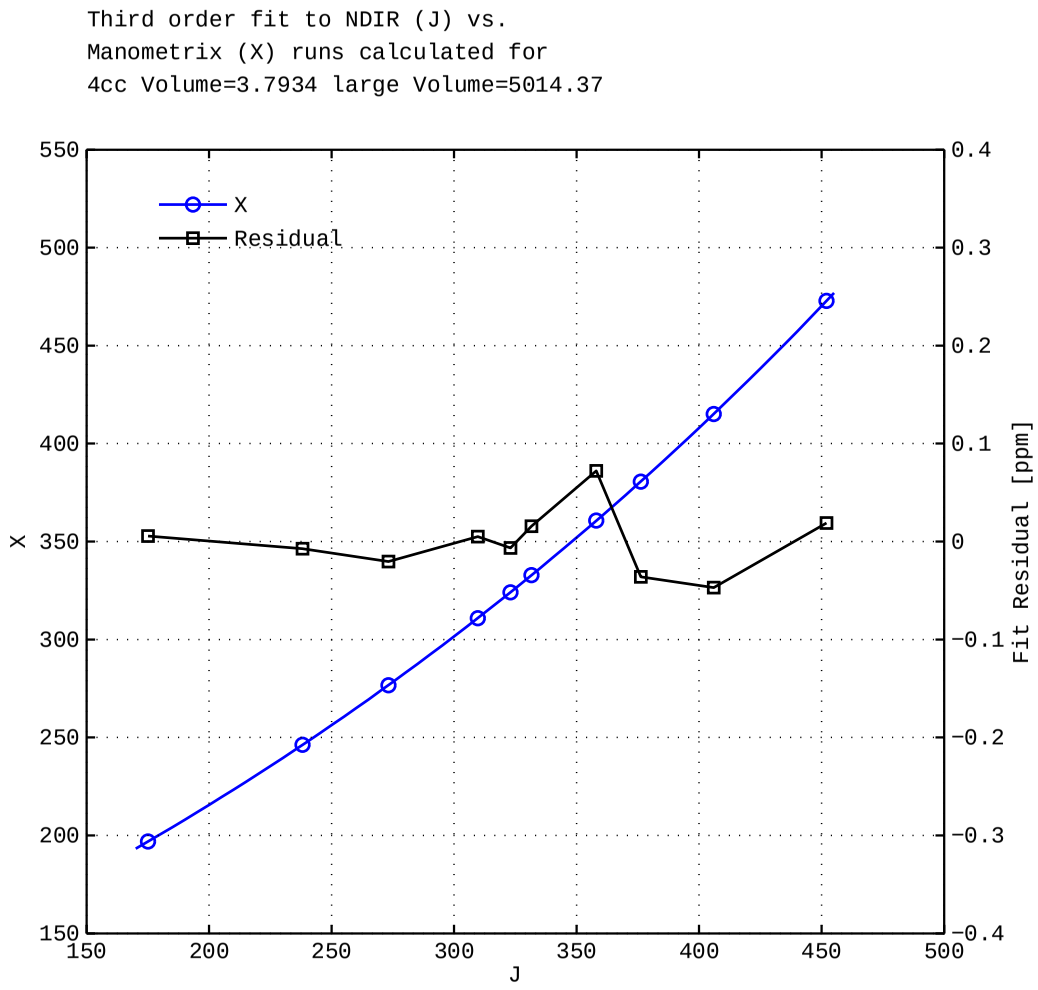


Cyl	J	X	Fit	Res
71251	194.625	213.164	213.132	+0.032
34819	242.140	251.848	251.929	−0.080
71286	291.559	296.662	296.670	−0.008
71341	317.479	322.216	322.091	+0.126
66638	333.250	338.241	338.257	−0.016
66625	339.277	344.579	344.579	+0.001
66696	353.720	360.004	360.060	−0.056
71308	368.353	376.250	376.232	+0.018
71370	394.516	406.417	406.408	+0.010
71479	432.676	453.403	453.456	−0.053
67615	470.279	503.567	503.539	+0.028
			Standard Deviation	0.056

Coefficients
+8.8009480e+01
+5.3560752e−01
+4.1801357e−04
+6.8451741e−07

Central Date: 29−Jul−1985

Figure B-2: Cubic fit of air primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1985 calibration period

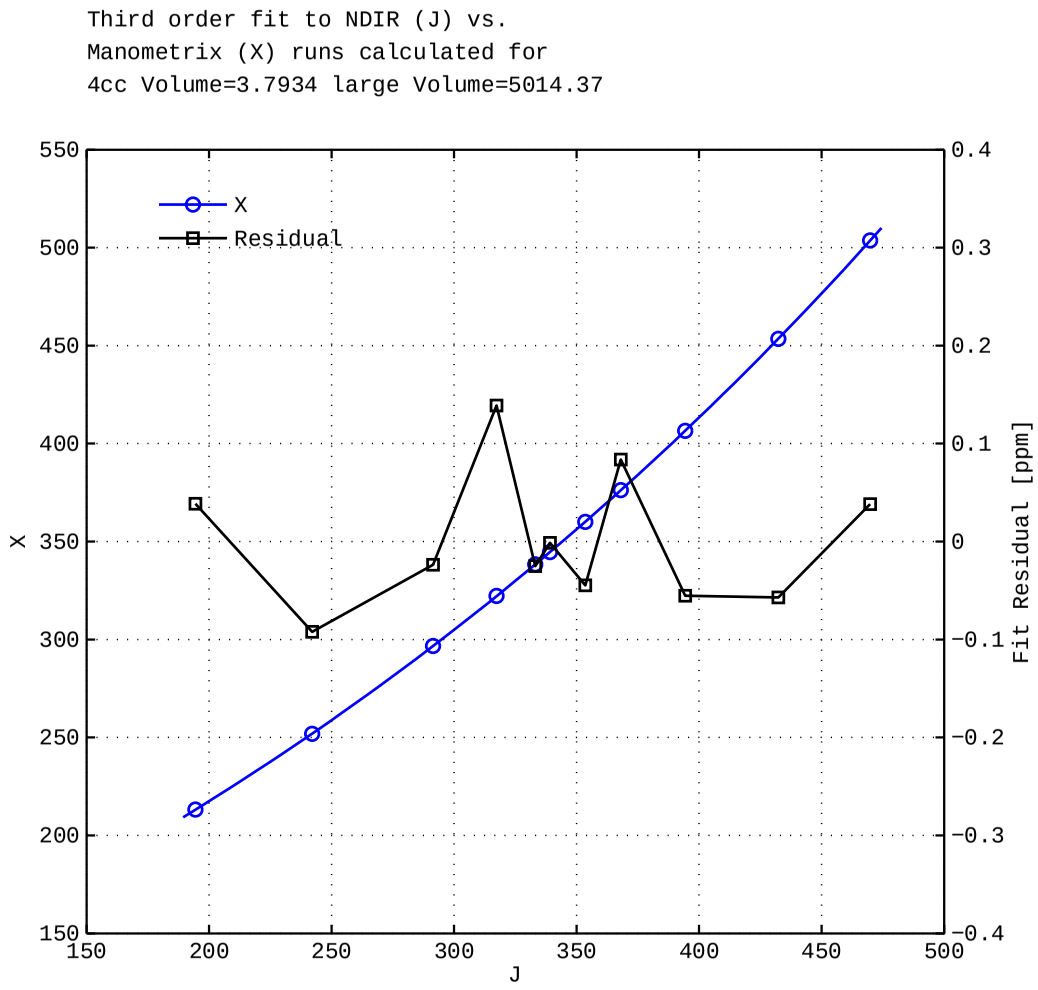


Cyl	J	X	Fit	Res
2408	175.102	196.873	196.867	+0.006
3753	238.182	246.237	246.244	−0.007
7366	273.214	276.672	276.692	−0.020
6078	309.663	310.903	310.898	+0.005
2399	323.001	324.090	324.097	−0.007
39239	331.571	332.793	332.777	+0.016
39272	358.034	360.671	360.599	+0.072
1540	376.225	380.607	380.643	−0.036
35299	405.995	415.087	415.134	−0.047
35316	452.032	472.833	472.814	+0.019
			Standard Deviation	0.033

Coefficients
+8.8951442e+01
+5.2163260e−01
+4.2431314e−04
+6.6439670e−07

Central Date: 06−Dec−1987

Figure B-3: Cubic fit of nitrogen primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1987 calibration period

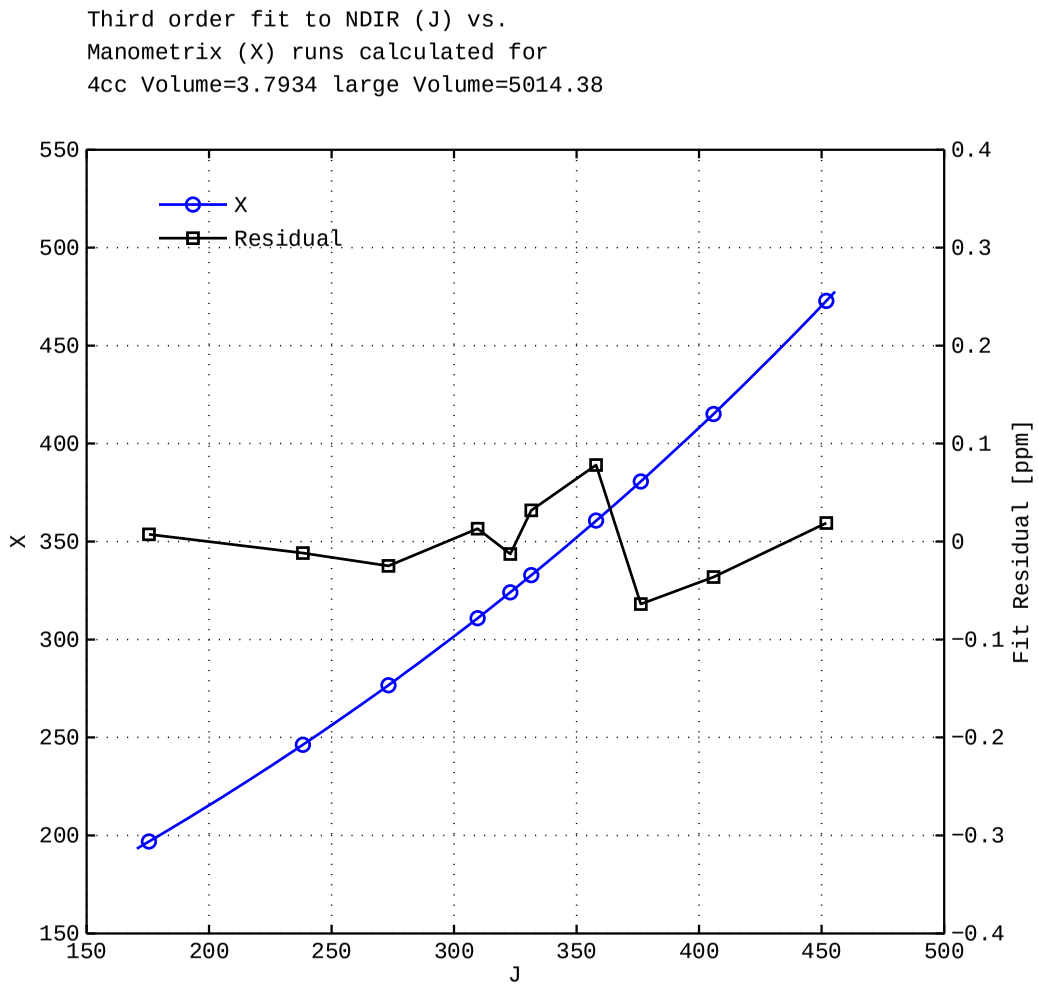


Cyl	J	X	Fit	Res
71251	194.451	213.164	213.125	+0.039
34819	242.086	251.895	251.987	−0.092
71286	291.459	296.672	296.696	−0.024
71341	317.306	322.205	322.066	+0.139
66638	333.143	338.295	338.320	−0.025
66625	339.116	344.593	344.594	−0.001
66696	353.564	360.061	360.106	−0.045
71308	368.068	376.248	376.164	+0.084
71370	394.324	406.457	406.513	−0.055
71479	432.322	453.431	453.488	−0.057
67615	469.850	503.668	503.630	+0.038
			Standard Deviation	0.069

Coefficients
+8.8421354e+01
+5.3405876e−01
+4.1559472e−04
+6.9931253e−07

Central Date: 06−Dec−1987

Figure B-4: Cubic fit of air primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1987 calibration period



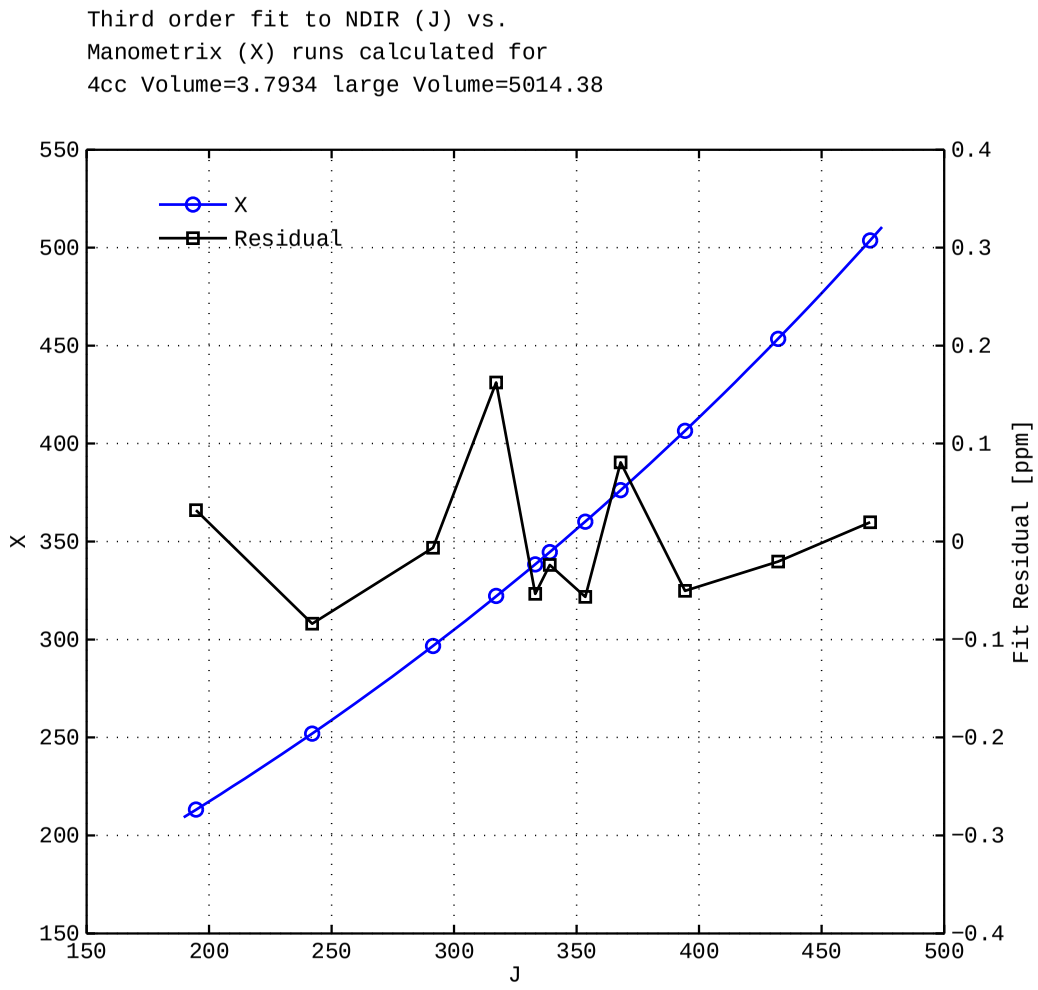
Cyl	J	X	Fit	Res
2408	175.512	196.878	196.870	+0.007
3753	238.294	246.268	246.280	−0.012
7366	273.214	276.671	276.696	−0.025
6078	309.616	310.900	310.887	+0.013
2399	322.958	324.082	324.095	−0.013
39239	331.519	332.801	332.769	+0.032
39272	357.983	360.676	360.597	+0.078
1540	376.208	380.622	380.686	−0.064
35299	405.930	415.104	415.140	−0.036
35316	451.915	472.840	472.821	+0.019

Standard Deviation 0.039

Coefficients
+8.6428635e+01
+5.4337081e−01
+3.6215343e−04
+7.2457290e−07

Central Date: 03−Mar−1989

Figure B-5: Cubic fit of nitrogen primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1989 calibration period

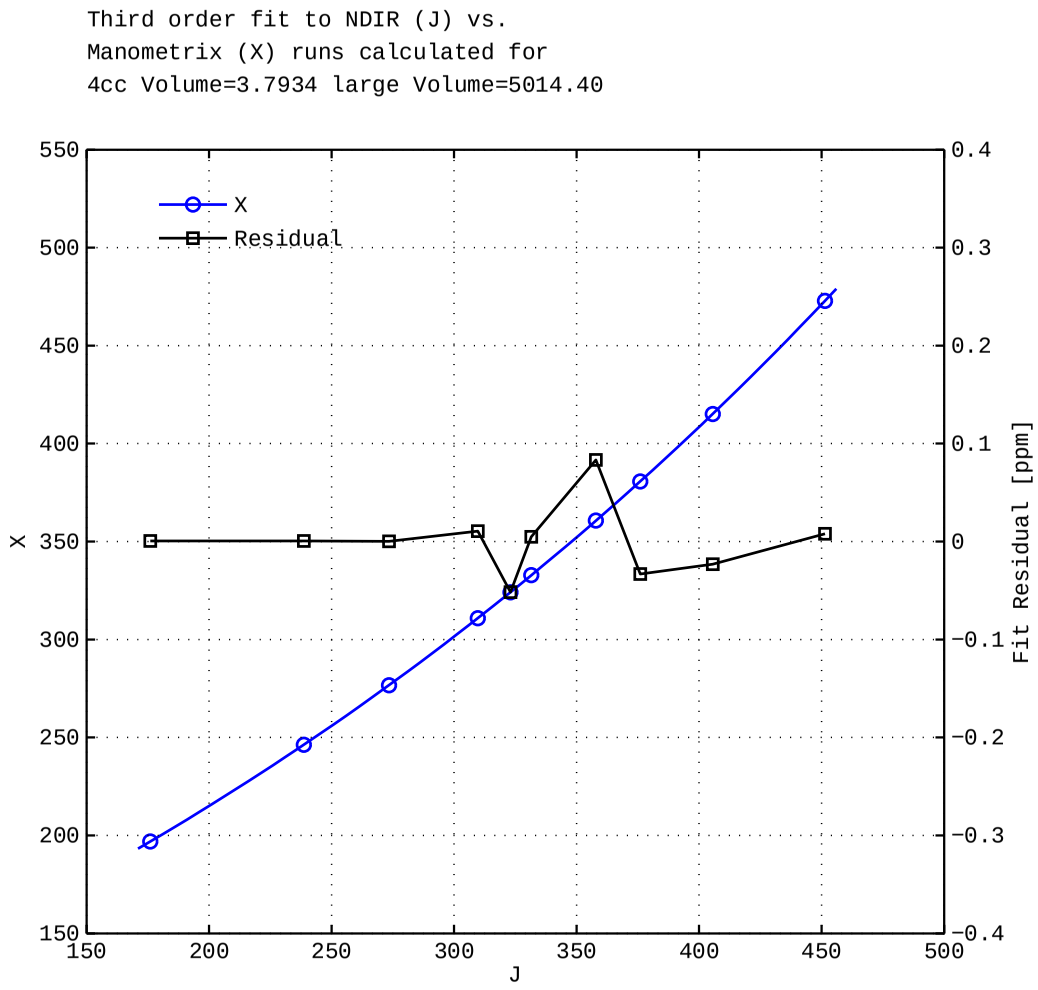


Cyl	J	X	Fit	Res
71251	194.666	213.164	213.132	+0.032
34819	242.120	251.920	252.004	−0.084
71286	291.388	296.678	296.684	−0.006
71341	317.208	322.199	322.036	+0.162
66638	333.128	338.323	338.377	−0.053
66625	339.075	344.600	344.624	−0.024
66696	353.535	360.092	360.148	−0.056
71308	368.004	376.246	376.165	+0.081
71370	394.275	406.478	406.529	−0.050
71479	432.237	453.446	453.467	−0.020
67615	469.809	503.722	503.702	+0.020
			Standard Deviation	0.071

Coefficients
+8.6158478e+01
+5.5333635e−01
+3.6262044e−04
+7.4779432e−07

Central Date: 03−Mar−1989

Figure B-6: Cubic fit of air primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1989 calibration period



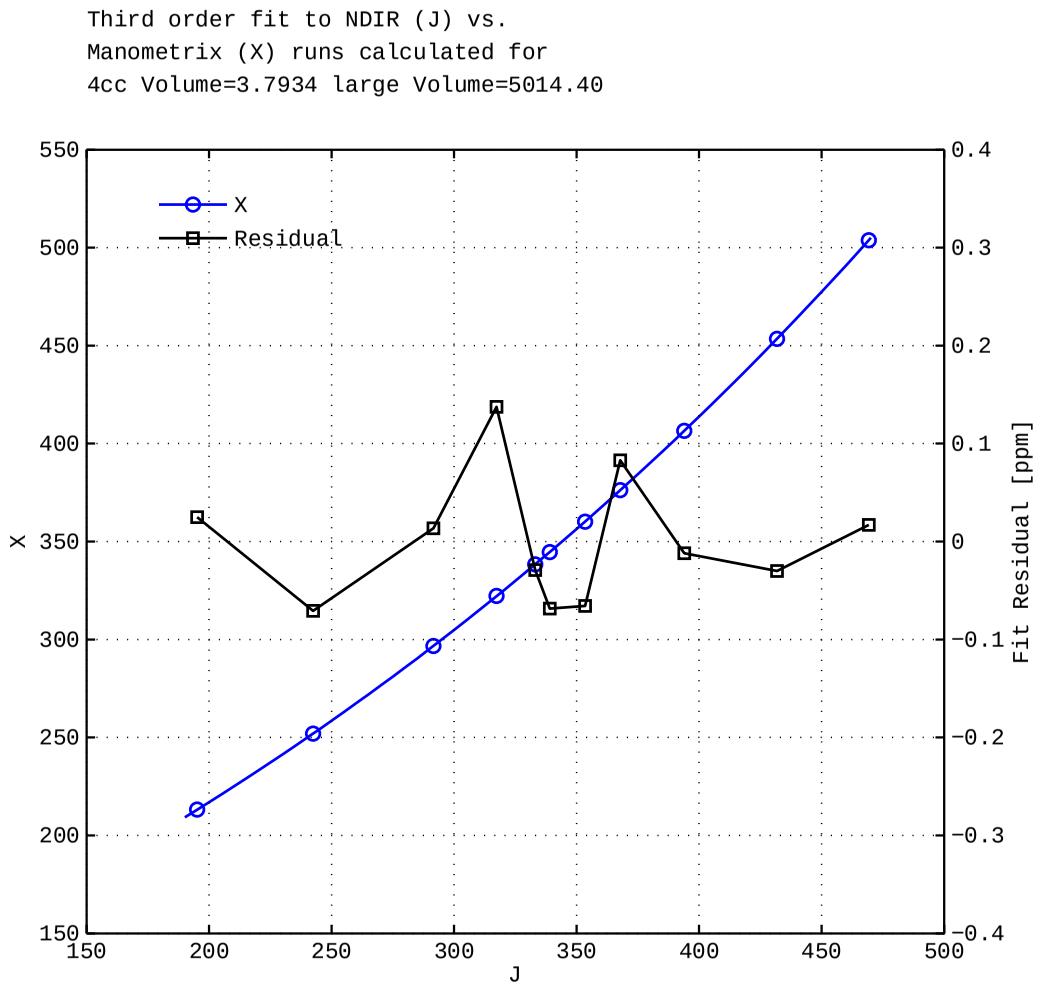
Cyl	J	X	Fit	Res
2408	176.021	196.882	196.882	+0.001
3753	238.708	246.298	246.298	+0.000
7366	273.448	276.670	276.670	+0.000
6078	309.716	310.898	310.887	+0.011
2399	323.026	324.075	324.126	−0.052
39239	331.549	332.808	332.804	+0.005
39272	357.853	360.680	360.597	+0.083
1540	375.979	380.637	380.670	−0.033
35299	405.586	415.121	415.144	−0.023
35316	451.400	472.846	472.838	+0.008

Standard Deviation 0.036

Coefficients
+8.7257233e+01
+5.2977109e−01
+4.0686706e−04
+6.9079957e−07

Central Date: 22−May−1990

Figure B-7: Cubic fit of nitrogen primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1990 calibration period

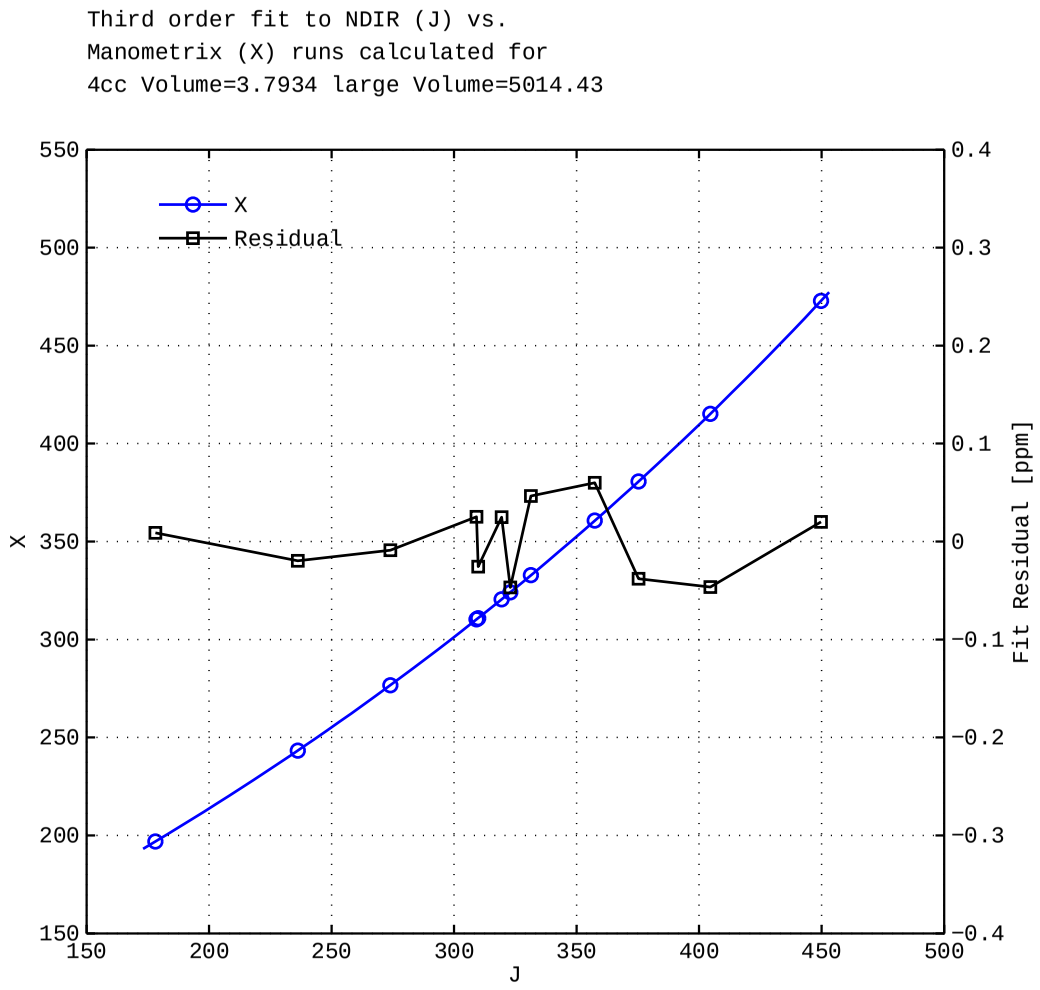


Cyl	J	X	Fit	Res
71251	195.148	213.164	213.139	+0.025
34819	242.508	251.944	252.015	−0.071
71286	291.557	296.683	296.670	+0.014
71341	317.293	322.193	322.055	+0.138
66638	333.123	338.351	338.380	−0.029
66625	339.087	344.607	344.676	−0.068
66696	353.466	360.121	360.187	−0.066
71308	367.829	376.245	376.162	+0.083
71370	393.970	406.499	406.511	−0.012
71479	431.810	453.461	453.491	−0.030
67615	469.272	503.774	503.757	+0.017
			Standard Deviation	0.065

Coefficients
+8.7093478e+01
+5.3877584e−01
+4.1008218e−04
+7.1147549e−07

Central Date: 22−May−1990

Figure B-8: Cubic fit of air primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1990 calibration period

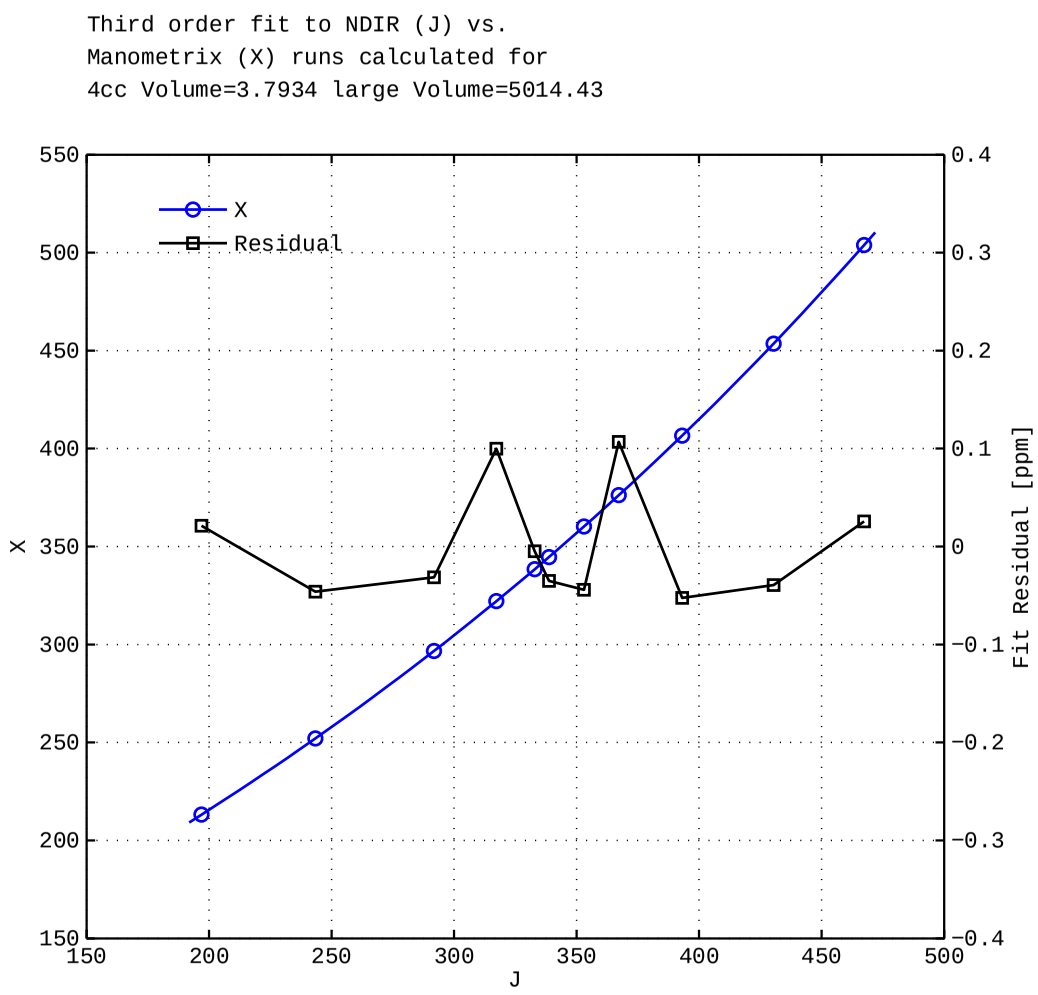


Cyl	J	X	Fit	Res
2408	178.107	196.895	196.886	+0.009
4274	236.208	243.286	243.306	−0.020
7366	274.001	276.668	276.677	−0.009
6071	309.146	310.247	310.221	+0.025
6078	309.848	310.892	310.917	−0.026
4296	319.387	320.507	320.482	+0.025
2399	322.948	324.056	324.103	−0.047
39239	331.373	332.828	332.781	+0.046
39272	357.424	360.693	360.633	+0.060
1540	375.340	380.673	380.711	−0.038
35299	404.606	415.162	415.208	−0.046
35316	449.780	472.863	472.843	+0.020
			Standard Deviation	0.036

Coefficients
+8.2349129e+01
+5.5876927e−01
+3.3268398e−04
+7.8982815e−07

Central Date: 20−May−1993

Figure B-9: Cubic fit of nitrogen primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1993 calibration period

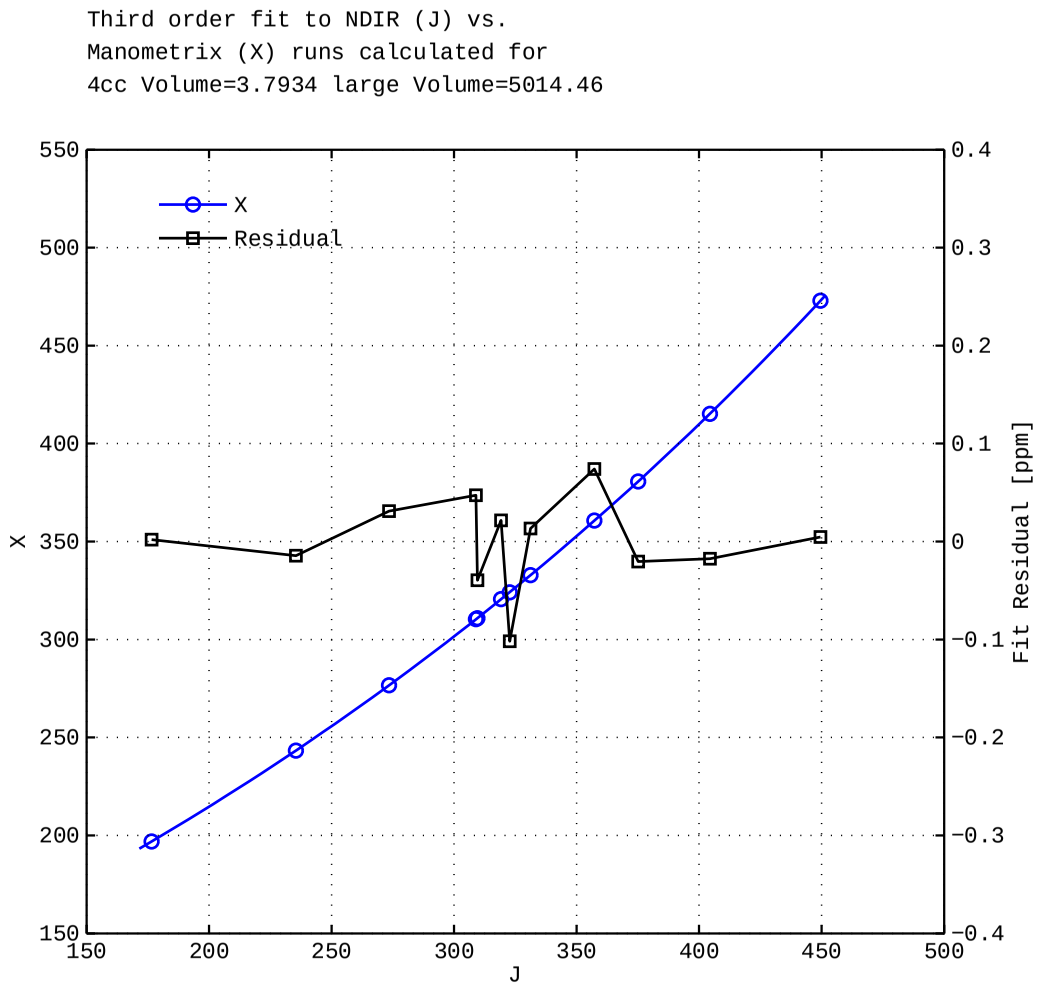


Cyl	J	X	Fit	Res
71251	196.879	213.164	213.143	+0.021
34819	243.410	252.004	252.050	−0.046
71286	291.839	296.698	296.729	−0.031
71341	317.247	322.178	322.078	+0.100
66638	332.923	338.420	338.425	−0.005
66625	338.765	344.625	344.660	−0.035
66696	353.047	360.195	360.239	−0.044
71308	367.176	376.241	376.134	+0.107
71370	393.105	406.549	406.602	−0.052
71479	430.401	453.497	453.536	−0.039
67615	467.337	503.904	503.878	+0.026
			Standard Deviation	0.058

Coefficients
+7.9667590e+01
+5.9271913e−01
+2.5743622e−04
+8.9142171e−07

Central Date: 20−May−1993

Figure B-10: Cubic fit of air primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1993 calibration period

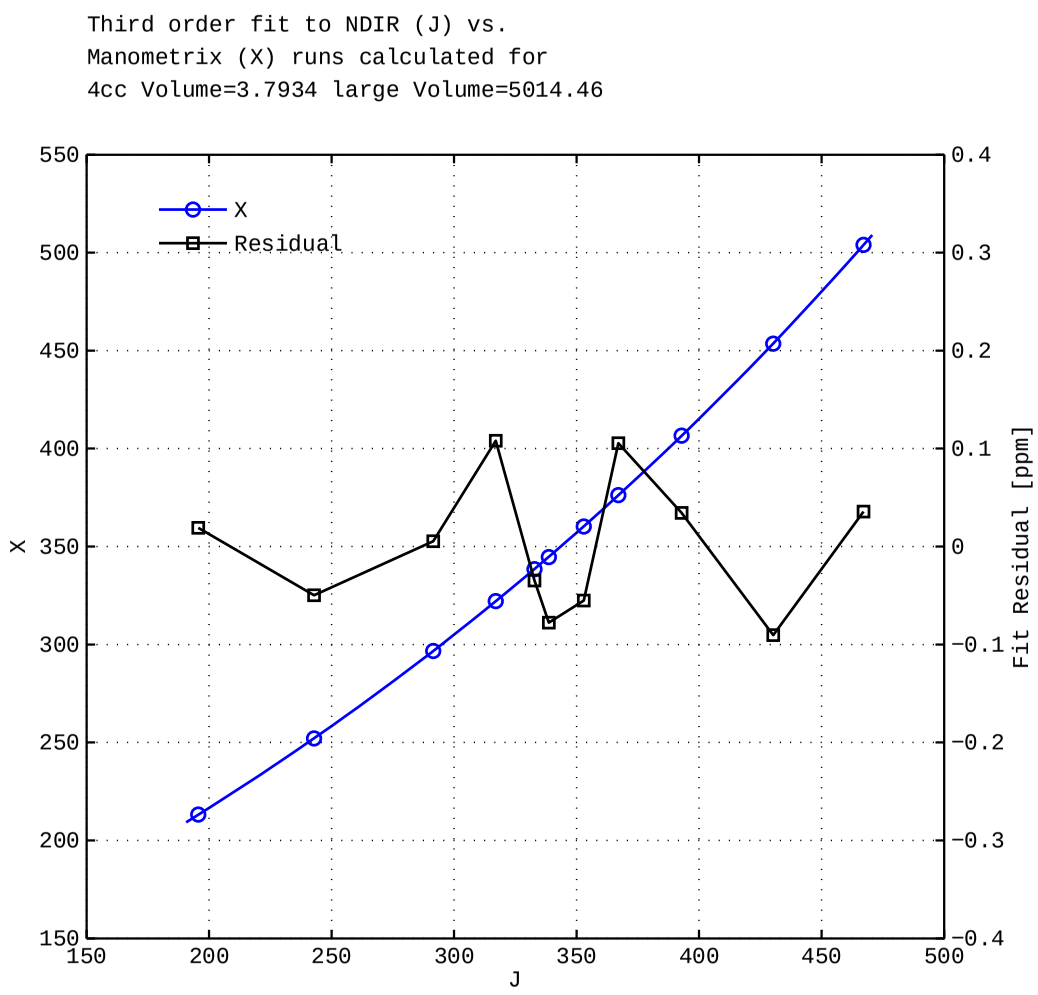


Cyl	J	X	Fit	Res
2408	176.582	196.903	196.901	+0.002
4274	235.472	243.322	243.336	−0.014
7366	273.485	276.667	276.636	+0.031
6071	308.914	310.335	310.288	+0.047
6078	309.560	310.887	310.926	−0.039
4296	319.168	320.551	320.529	+0.022
2399	322.733	324.043	324.145	−0.102
39239	331.183	332.841	332.828	+0.013
39272	357.225	360.701	360.627	+0.074
1540	375.162	380.698	380.718	−0.020
35299	404.411	415.191	415.209	−0.018
35316	449.538	472.875	472.870	+0.005
			Standard Deviation	0.045

Coefficients
+8.6386741e+01
+5.3614788e−01
+3.7099179e−04
+7.7596891e−07

Central Date: 09−Jul−1995

Figure B-11: Cubic fit of nitrogen primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1995 calibration period

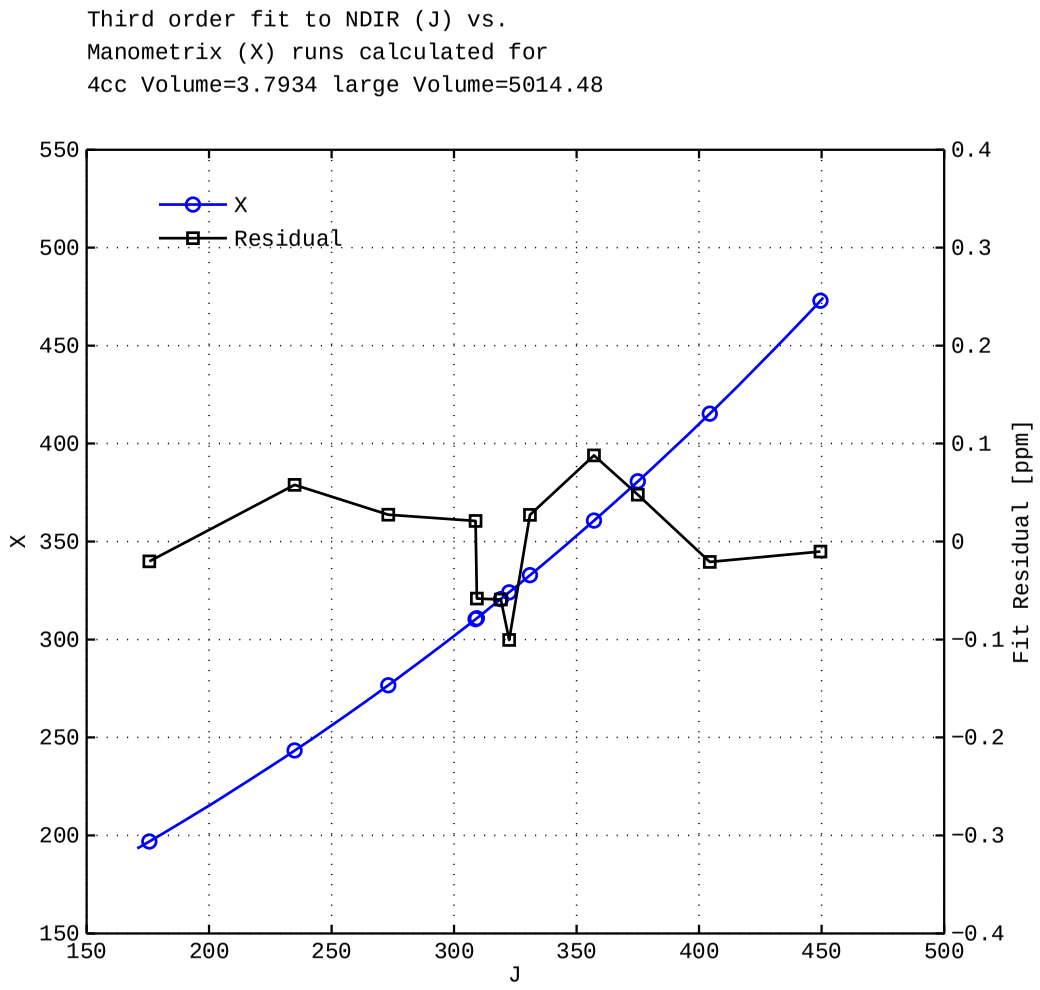


Cyl	J	X	Fit	Res
71251	195.638	213.164	213.145	+0.019
34819	242.822	252.046	252.096	−0.050
71286	291.508	296.708	296.703	+0.005
71341	317.016	322.168	322.060	+0.108
66638	332.818	338.469	338.504	−0.035
66625	338.646	344.638	344.715	−0.078
66696	352.947	360.247	360.303	−0.055
71308	367.022	376.238	376.133	+0.105
71370	392.898	406.586	406.552	+0.034
71479	430.243	453.522	453.613	−0.090
67615	467.106	503.996	503.960	+0.036
			Standard Deviation	0.068

Coefficients
+8.4790601e+01
+5.6004859e−01
+3.2417627e−04
+8.5202886e−07

Central Date: 09−Jul−1995

Figure B-12: Cubic fit of air primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1995 calibration period

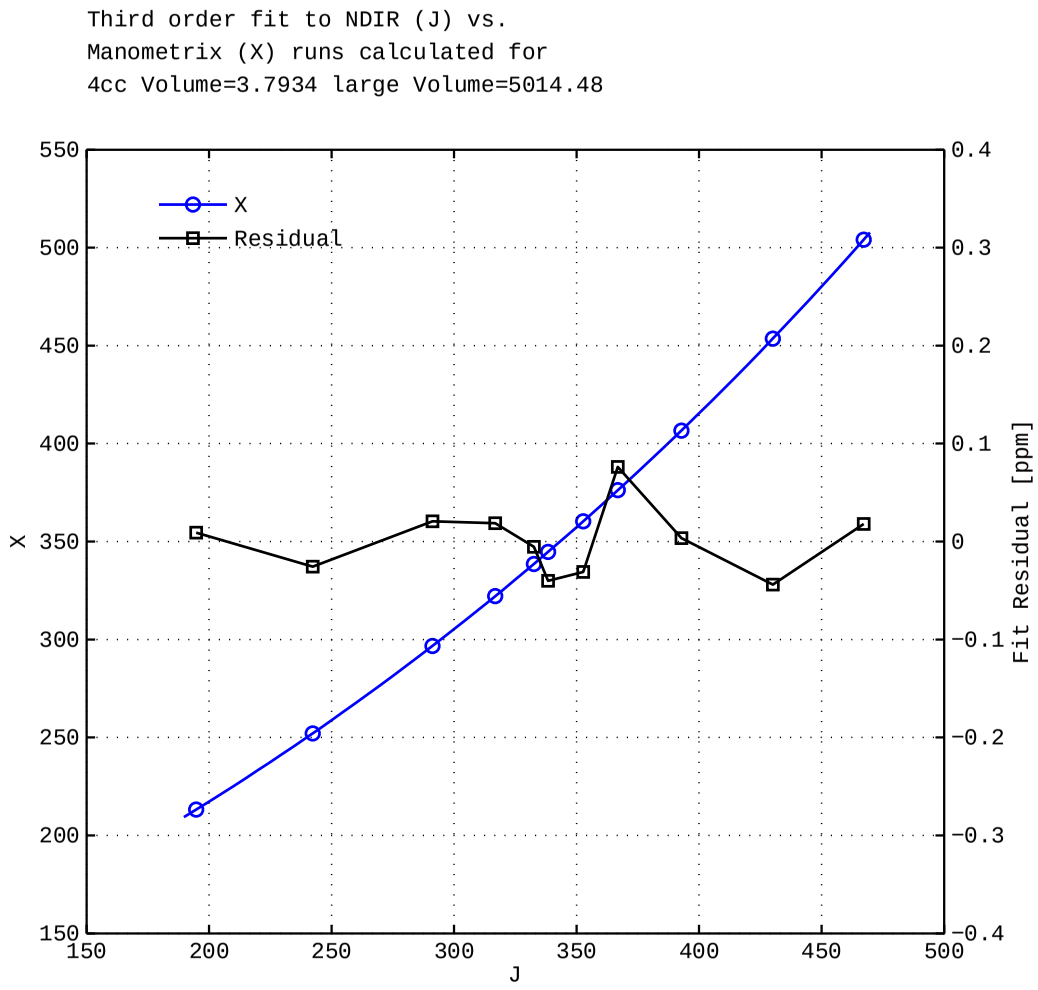


Cyl	J	X	Fit	Res
2408	175.670	196.912	196.932	−0.020
4274	234.933	243.357	243.299	+0.058
7366	273.158	276.666	276.638	+0.027
6071	308.797	310.423	310.402	+0.021
6078	309.343	310.882	310.941	−0.058
4296	319.080	320.595	320.654	−0.059
2399	322.514	324.029	324.130	−0.100
39239	330.993	332.855	332.827	+0.027
39272	357.071	360.710	360.622	+0.088
1540	374.999	380.723	380.675	+0.048
35299	404.350	415.221	415.242	−0.021
35316	449.534	472.886	472.897	−0.010
			Standard Deviation	0.055

Coefficients
+8.9270938e+01
+5.1621597e−01
+4.2192033e−04
+7.2991402e−07

Central Date: 19−Aug−1997

Figure B-13: Cubic fit of nitrogen primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1997 calibration period

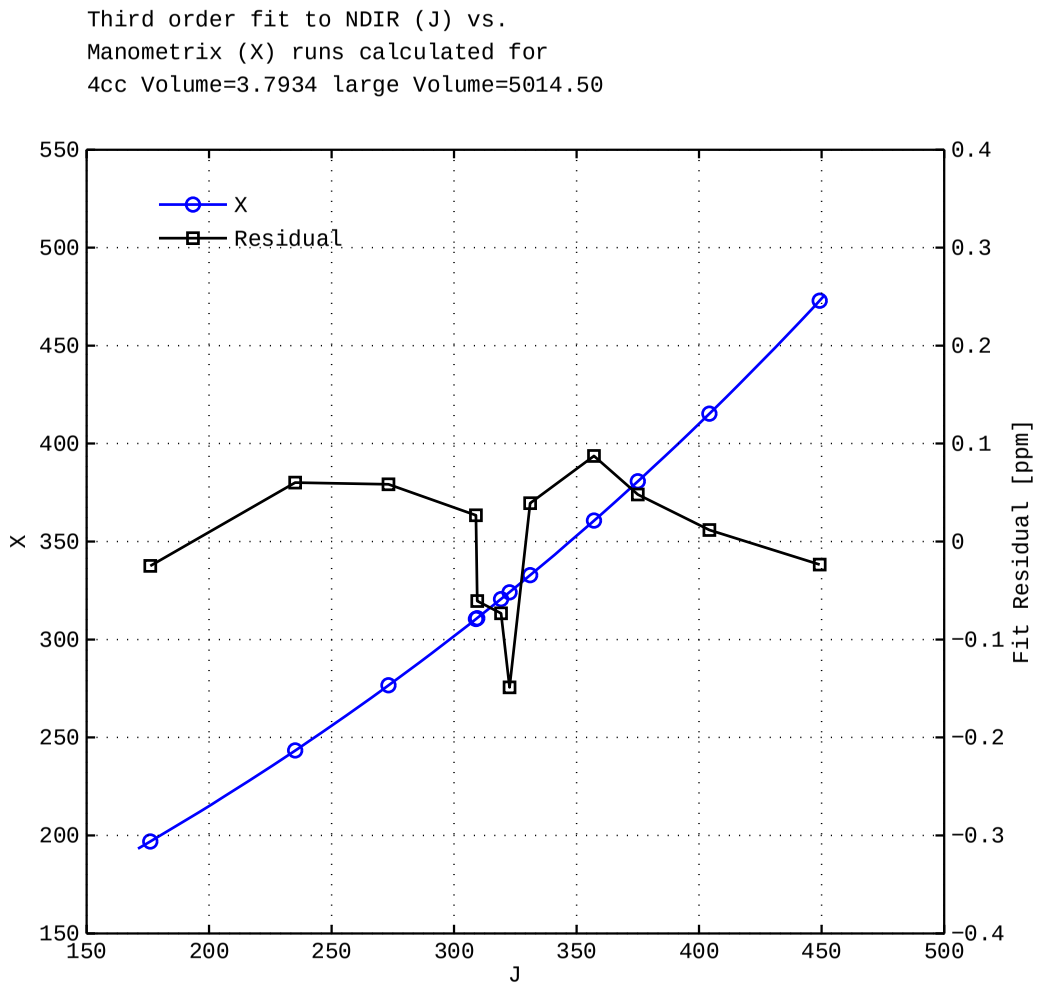


Cyl	J	X	Fit	Res
71251	194.768	213.165	213.156	+0.009
34819	242.340	252.088	252.114	−0.026
71286	291.174	296.718	296.698	+0.021
71341	316.811	322.158	322.139	+0.019
66638	332.575	338.518	338.523	−0.005
66625	338.368	344.650	344.690	−0.040
66696	352.735	360.299	360.331	−0.031
71308	366.825	376.236	376.159	+0.076
71370	392.771	406.622	406.618	+0.004
71479	430.126	453.548	453.592	−0.044
67615	467.206	504.087	504.069	+0.018
			Standard Deviation	0.035

Coefficients
+8.9424432e+01
+5.2291767e−01
+4.3141107e−04
+7.4684974e−07

Central Date: 19−Aug−1997

Figure B-14: Cubic fit of air primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1997 calibration period

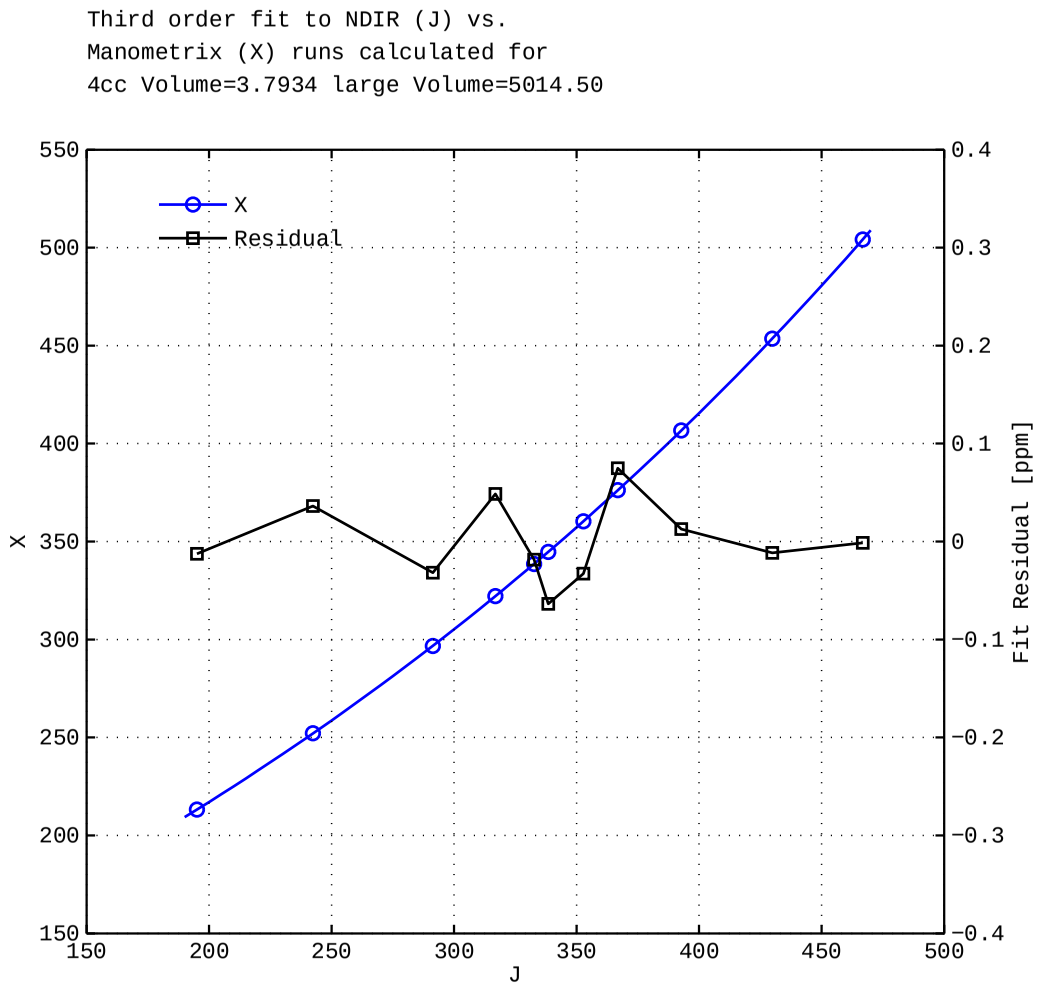


Cyl	J	X	Fit	Res
2408	176.046	196.917	196.942	−0.025
4274	235.150	243.380	243.319	+0.060
7366	273.268	276.665	276.606	+0.058
6071	308.953	310.480	310.453	+0.027
6078	309.446	310.879	310.940	−0.061
4296	319.212	320.623	320.696	−0.073
2399	322.638	324.021	324.170	−0.149
39239	331.061	332.863	332.824	+0.039
39272	357.095	360.715	360.628	+0.087
1540	374.984	380.739	380.691	+0.048
35299	404.209	415.240	415.228	+0.012
35316	449.202	472.894	472.917	−0.024
			Standard Deviation	0.069

Coefficients
+8.7332862e+01
+5.3493344e−01
+3.5502030e−04
+8.1259534e−07

Central Date: 01−Jan−1999

Figure B-15: Cubic fit of nitrogen primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1999 calibration period

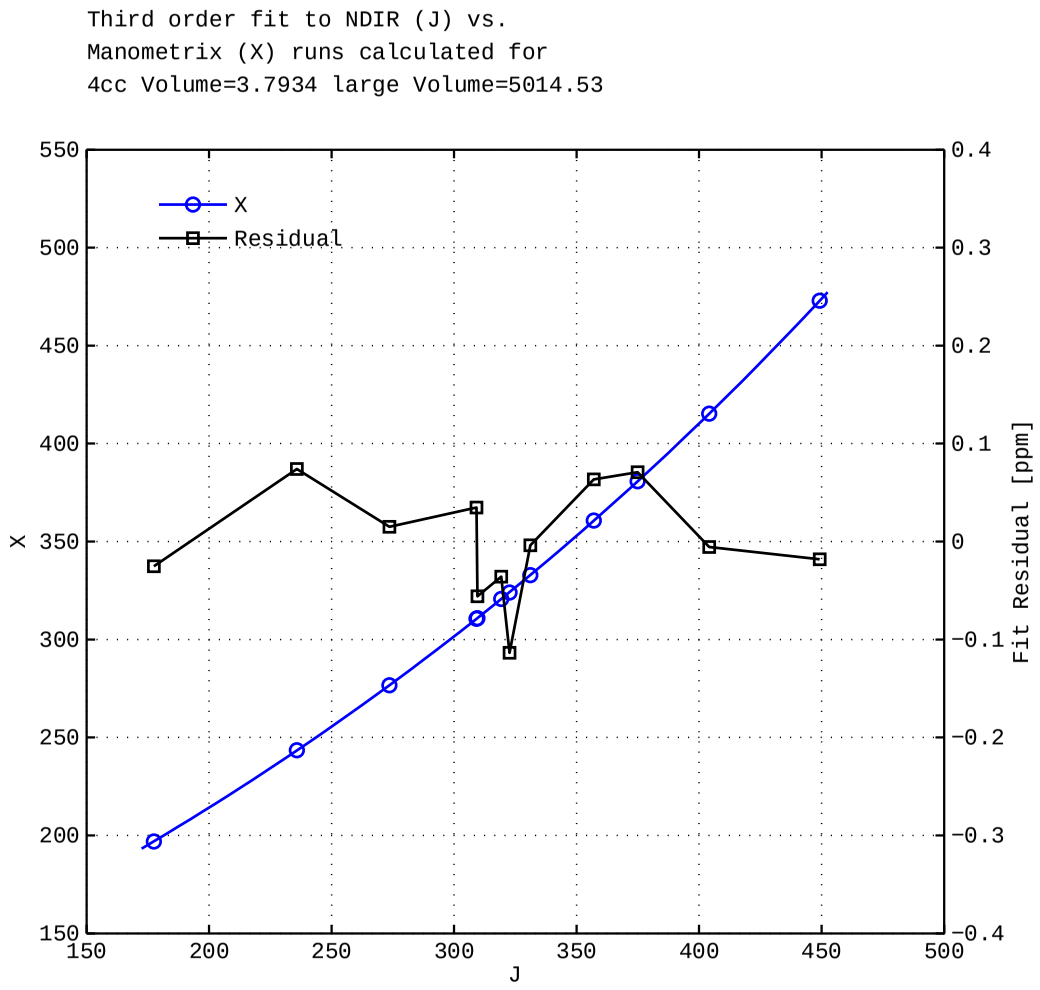


Cyl	J	X	Fit	Res
71251	195.070	213.165	213.178	−0.013
34819	242.425	252.116	252.079	+0.036
71286	291.325	296.725	296.756	−0.032
71341	316.854	322.151	322.103	+0.049
66638	332.684	338.550	338.568	−0.018
66625	338.458	344.658	344.722	−0.064
66696	352.808	360.333	360.366	−0.033
71308	366.839	376.234	376.159	+0.075
71370	392.725	406.645	406.632	+0.013
71479	429.892	453.564	453.576	−0.012
67615	466.796	504.146	504.148	−0.001
			Standard Deviation	0.040

Coefficients
+8.6122322e+01
+5.5588082e−01
+3.1825660e−04
+8.7691585e−07

Central Date: 01−Jan−1999

Figure B-16: Cubic fit of air primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 1999 calibration period

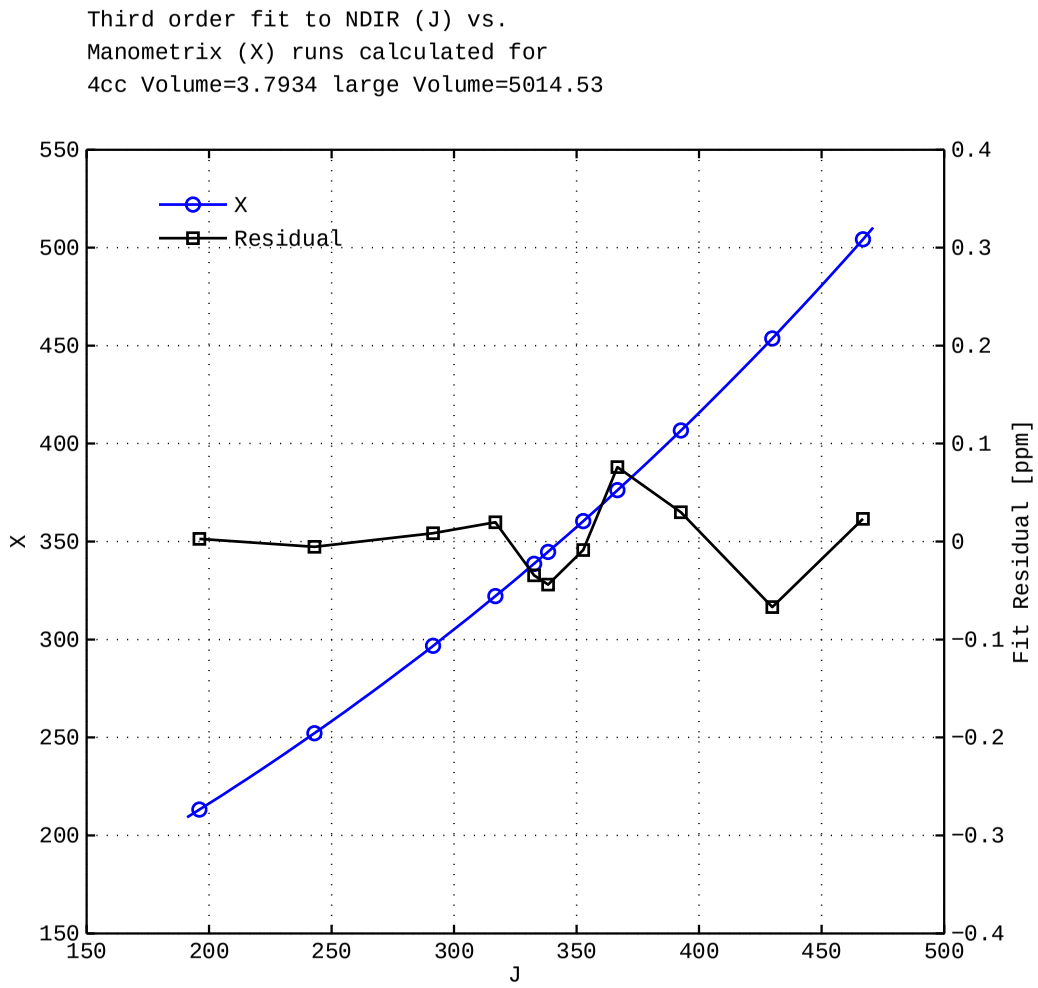


Cyl	J	X	Fit	Res
2408	177.445	196.927	196.953	−0.025
4274	235.855	243.422	243.348	+0.074
7366	273.641	276.664	276.649	+0.015
6071	309.146	310.584	310.549	+0.035
6078	309.529	310.874	310.930	−0.056
4296	319.273	320.675	320.711	−0.036
2399	322.619	324.005	324.118	−0.113
39239	331.115	332.879	332.882	−0.004
39272	357.052	360.725	360.662	+0.063
1540	374.894	380.769	380.698	+0.071
35299	404.165	415.275	415.280	−0.006
35316	449.241	472.907	472.925	−0.018
			Standard Deviation	0.056

Coefficients
+8.5270257e+01
+5.3669135e−01
+3.8939939e−04
+7.4961768e−07

Central Date: 10−Jul−2001

Figure B-17: Cubic fit of nitrogen primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 2001 calibration period

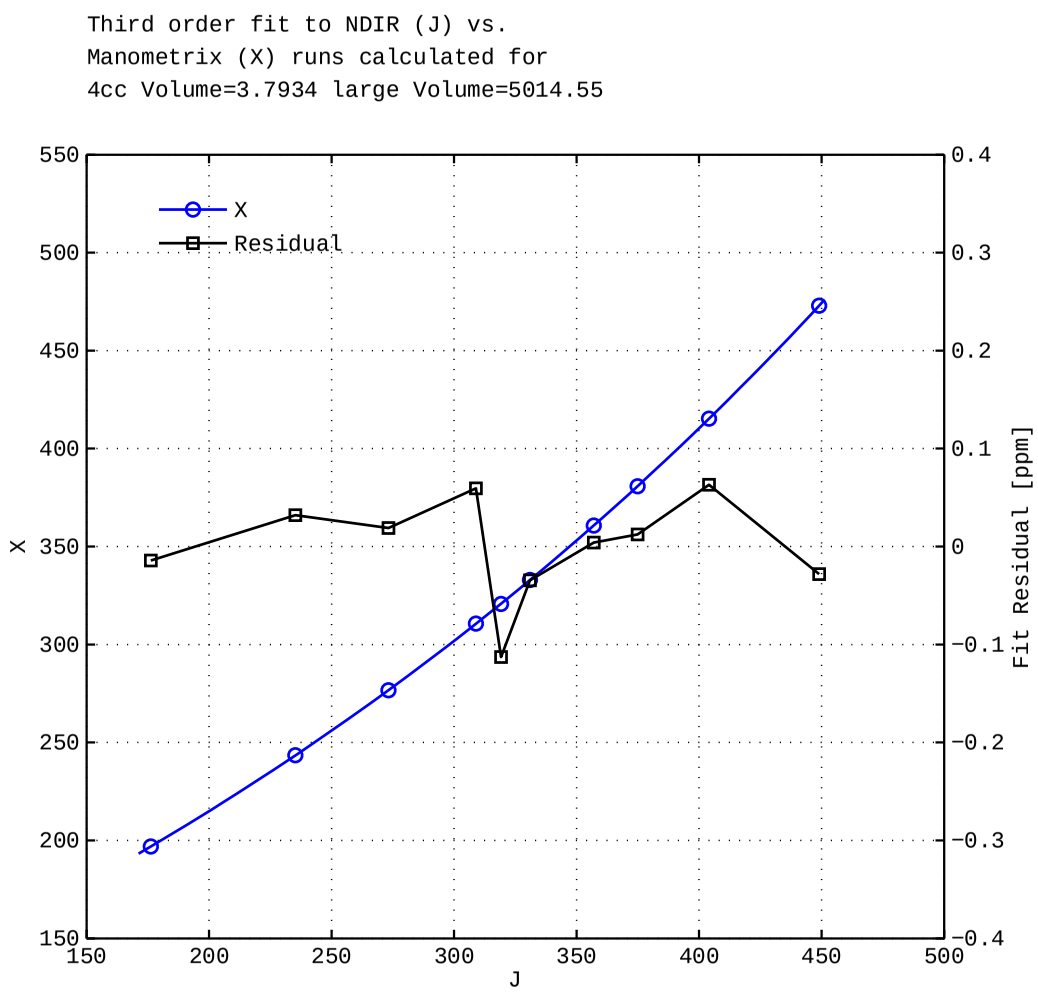


Cyl	J	X	Fit	Res
71251	196.087	213.165	213.162	+0.003
34819	243.042	252.166	252.171	−0.005
71286	291.425	296.736	296.728	+0.008
71341	316.865	322.139	322.119	+0.020
66638	332.687	338.607	338.642	−0.035
66625	338.368	344.672	344.716	−0.044
66696	352.721	360.395	360.404	−0.009
71308	366.691	376.230	376.155	+0.076
71370	392.591	406.688	406.658	+0.030
71479	429.853	453.594	453.661	−0.067
67615	466.874	504.255	504.232	+0.023
			Standard Deviation	0.039

Coefficients
+8.3826354e+01
+5.6090544e−01
+3.4098056e−04
+8.2748854e−07

Central Date: 10−Jul−2001

Figure B-18: Cubic fit of air primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 2001 calibration period

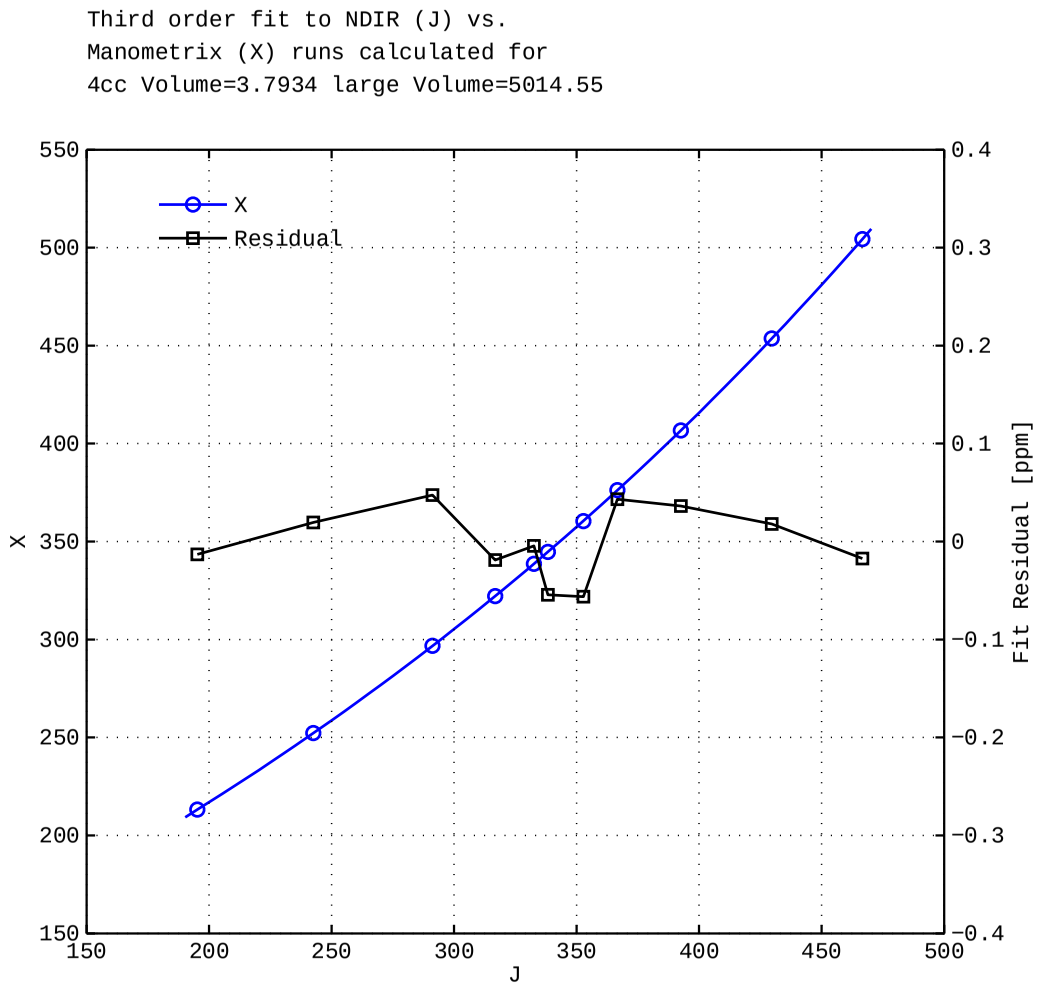


Cyl	J	X	Fit	Res
2408	176.270	196.935	196.949	−0.014
4274	235.240	243.454	243.422	+0.032
7366	273.200	276.663	276.644	+0.019
6071	308.960	310.663	310.604	+0.059
4296	319.190	320.715	320.828	−0.113
39239	331.000	332.890	332.925	−0.035
39272	357.020	360.733	360.729	+0.004
1540	374.890	380.792	380.779	+0.012
35299	404.040	415.301	415.238	+0.063
35316	449.030	472.918	472.946	−0.028
			Standard Deviation	0.052

Coefficients
+8.5757451e+01
+5.4788920e−01
+3.2190447e−04
+8.4235986e−07

Central Date: 09−Jun−2003

Figure B-19: Cubic fit of nitrogen primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 2003 calibration period

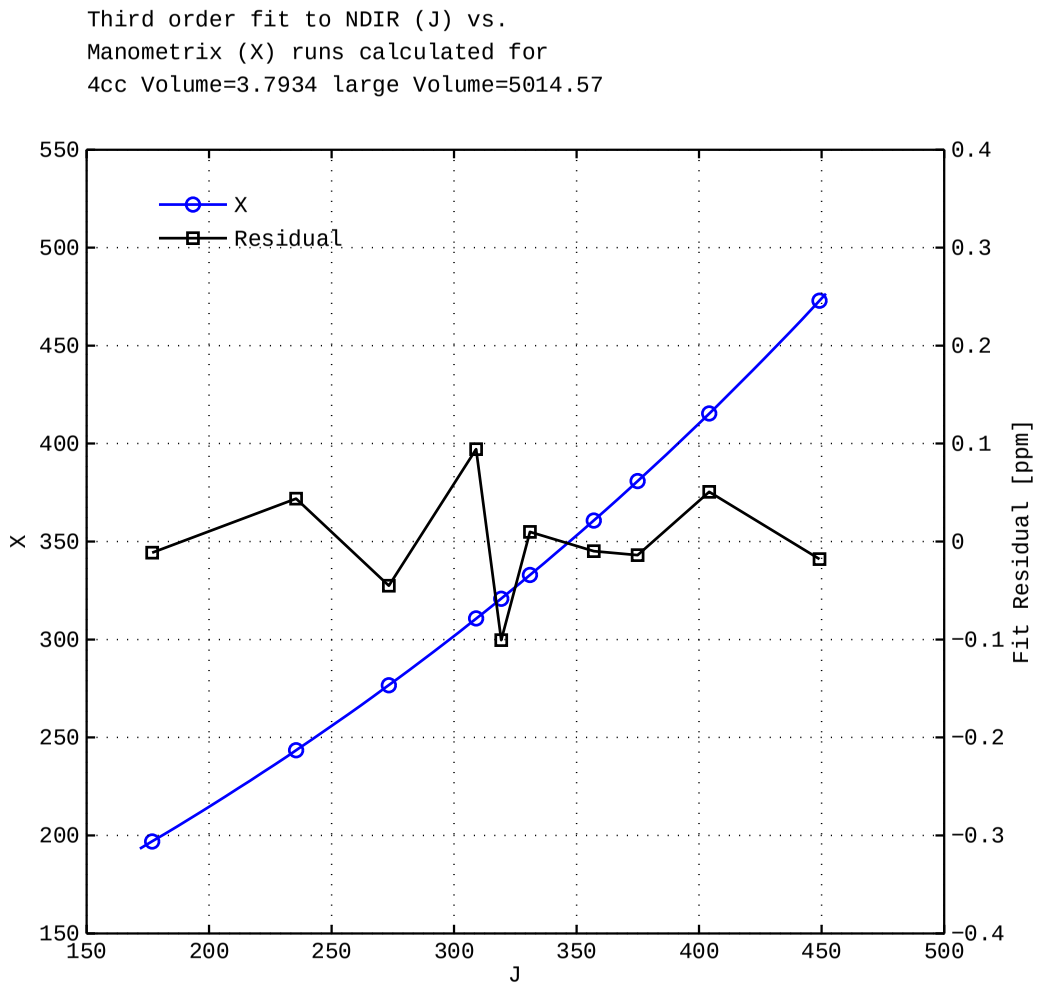


Cyl	J	X	Fit	Res
71251	195.250	213.165	213.178	−0.013
34819	242.560	252.204	252.184	+0.019
71286	291.180	296.745	296.698	+0.047
71341	316.780	322.130	322.148	−0.019
66638	332.630	338.651	338.656	−0.004
66625	338.330	344.683	344.738	−0.054
66696	352.770	360.442	360.499	−0.056
71308	366.690	376.228	376.185	+0.043
71370	392.570	406.720	406.684	+0.036
71479	429.670	453.617	453.599	+0.018
67615	466.650	504.338	504.355	−0.017
			Standard Deviation	0.036

Coefficients
+8.4635842e+01
+5.6759933e−01
+2.8757327e−04
+9.0757168e−07

Central Date: 09−Jun−2003

Figure B-20: Cubic fit of air primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 2003 calibration period

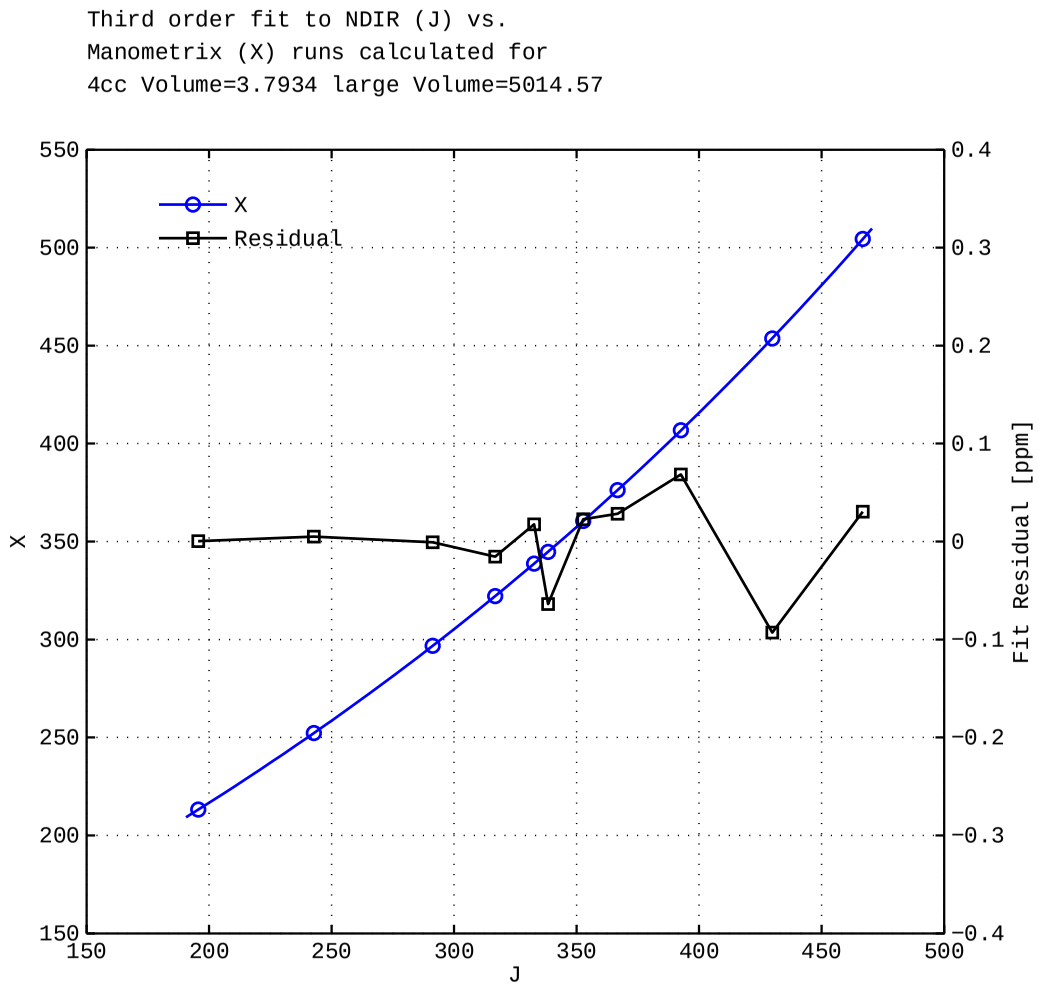


Cyl	J	X	Fit	Res
2408	176.800	196.942	196.953	−0.011
4274	235.510	243.483	243.439	+0.044
7366	273.380	276.662	276.707	−0.045
6071	309.020	310.735	310.641	+0.094
4296	319.220	320.751	320.852	−0.101
39239	330.960	332.901	332.891	+0.010
39272	357.020	360.740	360.750	−0.010
1540	374.920	380.812	380.826	−0.014
35299	404.100	415.325	415.274	+0.051
35316	449.190	472.927	472.945	−0.018
			Standard Deviation	0.054

Coefficients
+8.5353844e+01
+5.4353506e−01
+3.5642502e−04
+7.8915432e−07

Central Date: 04−Apr−2005

Figure B-21: Cubic fit of nitrogen primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 2005 calibration period

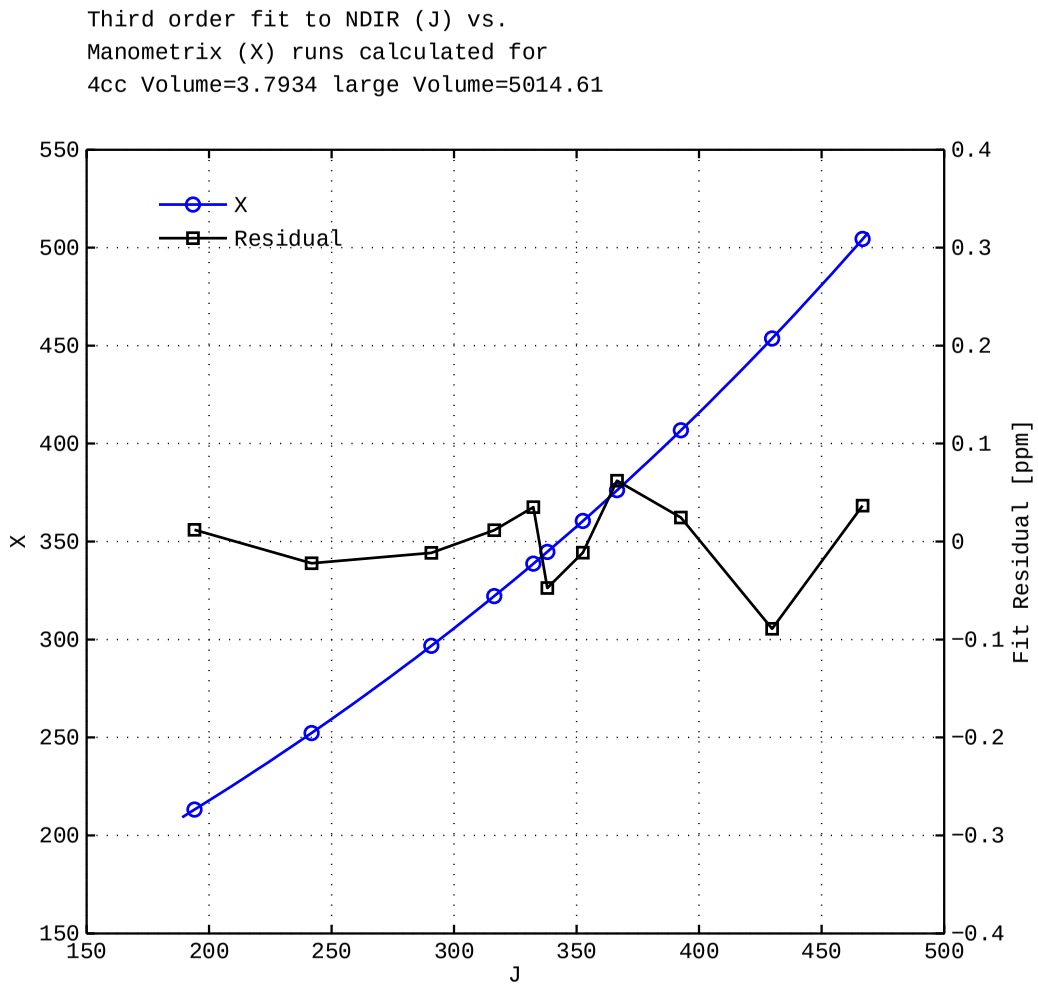


Cyl	J	X	Fit	Res
71251	195.610	213.165	213.165	+0.000
34819	242.780	252.238	252.233	+0.005
71286	291.280	296.753	296.754	−0.001
71341	316.780	322.121	322.136	−0.015
66638	332.650	338.691	338.673	+0.018
66625	338.350	344.693	344.757	−0.064
66696	352.740	360.485	360.462	+0.023
71308	366.710	376.226	376.198	+0.028
71370	392.600	406.750	406.682	+0.068
71479	429.860	453.638	453.731	−0.093
67615	466.840	504.412	504.381	+0.031
			Standard Deviation	0.045

Coefficients
+8.3251628e+01
+5.7459967e−01
+2.8198652e−04
+8.9861524e−07

Central Date: 04−Apr−2005

Figure B-22: Cubic fit of air primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 2005 calibration period

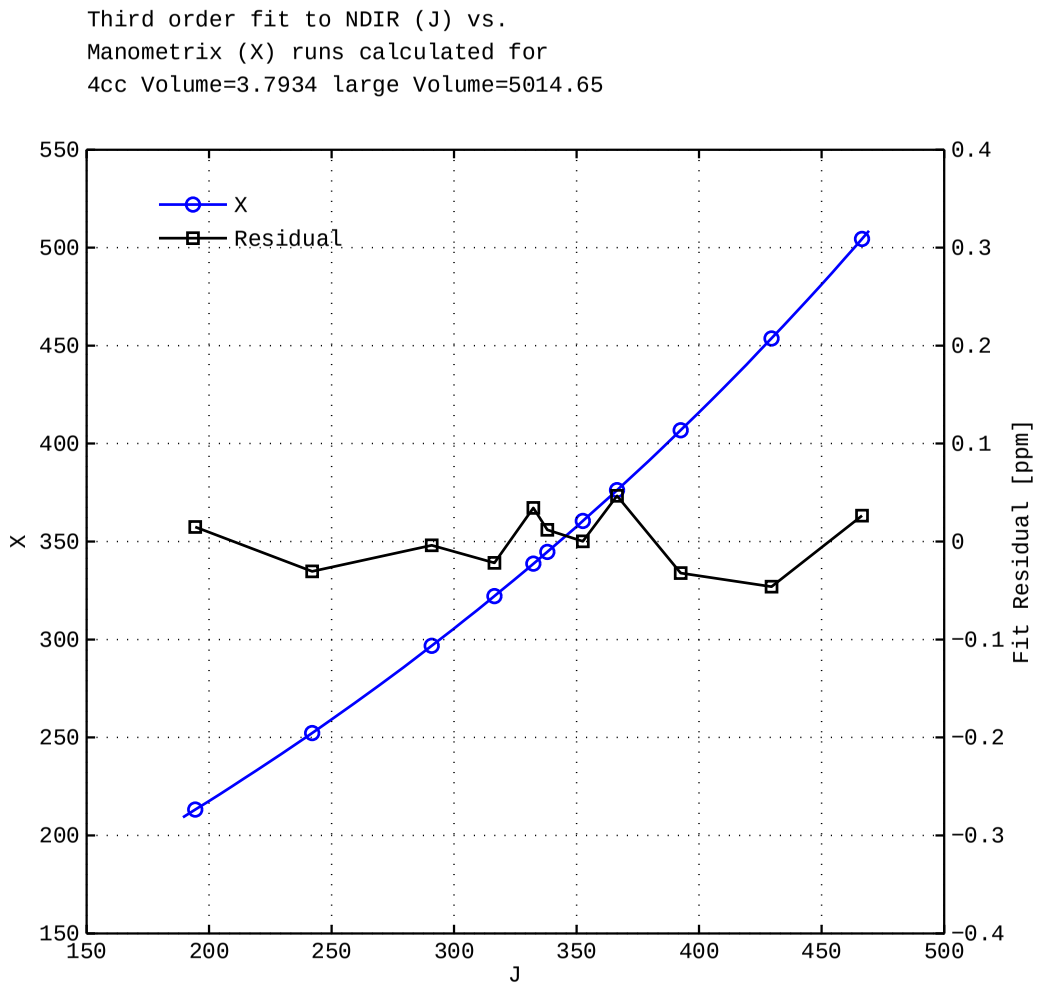


Cyl	J	X	Fit	Res
71251	194.030	213.165	213.153	+0.012
34819	241.820	252.238	252.260	−0.022
71286	290.750	296.753	296.765	−0.012
71341	316.390	322.121	322.110	+0.011
66638	332.360	338.691	338.656	+0.035
66625	338.090	344.693	344.740	−0.047
66696	352.590	360.485	360.496	−0.011
71308	366.550	376.226	376.164	+0.062
71370	392.570	406.750	406.726	+0.024
71479	429.820	453.638	453.727	−0.089
67615	466.760	504.412	504.375	+0.037
			Standard Deviation	0.043

Coefficients
+8.5783963e+01
+5.7076226e−01
+2.5876972e−04
+9.4212719e−07

Central Date: 16−Sep−2008

Figure B-23: Cubic fit of air primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 2008 calibration period



Cyl	J	X	Fit	Res
71251	194.370	213.165	213.150	+0.015
34819	242.070	252.238	252.268	−0.030
71286	290.870	296.753	296.757	−0.004
71341	316.490	322.121	322.143	−0.022
66638	332.390	338.691	338.657	+0.034
66625	338.050	344.693	344.681	+0.012
66696	352.560	360.485	360.485	+0.000
71308	366.510	376.226	376.179	+0.047
71370	392.500	406.750	406.782	−0.032
71479	429.580	453.638	453.684	−0.046
67615	466.470	504.412	504.386	+0.026
			Standard Deviation	0.030

Coefficients
+8.5425661e+01
+5.7083681e−01
+2.5978353e−04
+9.4732152e−07

Central Date: 13−Mar−2012

Figure B-24: Cubic fit of air primary tanks manometric carbon dioxide mole fractions as a function of APC J value for the 2012 calibration period

19 Appendix C. MATLAB and FORTRAN Code

Source Code 1 Matlab cdmncmmco2.m

```
function iquit=cdmncmmco2(icorcath,icormen);
% Calculates number of moles of CO2 in 4cc chamber
%
% Input:
%  input/CMMco2.dta'
%
% Output:
%  output/cmmco2.csv';
%
MFILE=upper(mfilename);

if nargin<1,
  error('Need ICORCATH');
end
if nargin<2,
  error('Need ICORMEN');
end

iquit=1;

% Read co2 column data
%
fname='input/CMMco2.dta';
[T1,cyl,irun,gas,mencor,gasmm,i1,htvac,htsmp,temp,ofr,sflag,scom,lcom]=...
    cdmnreadcmmco2(fname);

% Apply stepwise meniscor correction
%
if any(icormen==[1 2]),
  mencor=cdmnmenisccor(T1,cyl,mencor,2,icormen);
end


% Uncertainty analysis - adjust the heights, temps
%
[htvac,htsmp,temp]=uncertadj(htvac,htsmp,temp);


% Correct heights
%
ilrg=0;
[htvac]=cdmnmanocor(htvac,ilrg,icorcath);
[htsmp]=cdmnmanocor(htsmp,ilrg,icorcath);


% Convert flag to float
%
flag=ones(size(T1));
I=strmatch('00',sflag);
flag(I)=0;

% Apply temperature correction at time T1
%
temp=cdmntempcor(temp,T1);

% Read Virial coefficients
%
Vircoef=virials('co2',temp);

% Mercury Density
%
Rhohgn=rhohg(temp);

% Look up small (4cc) chamber volume at each time T1
%
Smlvolco2=plnvols(T1,meshgrid('4',T1));

% Calculate CO2 pressure
%
presco2 =(htvac-htsmp+mencor).*Rhohgn*stdConst('gravconst')/10;


% Calculate moles of CO2, equation (1) of 2002 manometry report
%
step1=1+(4*presco2.*Vircoef)./(stdConst('gasconst').*(temp+stdConst('tk0c')));
step3=1000000;
molesCo2=step3*(-Smlvolco2./(2.0*Vircoef)).*(1.0-sqrt(step1));
```

```
% Write data to file
%
fname='output/cmmco2.csv';
fid=fopen(fname,'w');
if fid<1,
  fprintf(2,' %s: Couldn''t open %s\n',MFILE,fname);
  return
end
fprintf(2,' %s: Writing to %s\n',MFILE,fname);

[yr,mn,dy]=datevec(T1);

sfmt=['%4d-%2.2d-%2.2d, %6d, %4d, %4s, %7.3f, %7.3f, %5.3f, %5.2f,'...
      ' %5.3f, %1d, %8.5f, %11.8f, %s\n'];

fprintf(fid,'%%\n');
fprintf(fid,'%%\n');
fprintf(fid,'%%           Cyl.  Run             Mercury Column Data\n');
fprintf(fid,['%%  Date    number no       gas '...
      '         CO2        corr  Temp  OxyFr Fg       Vol  Moles(Gas)\n']);
fprintf(fid,'%%\n');

fprintf(fid,['%%    Date    number   no   gas    (mm)     (mm)    (mm) '...
     '    (C)'...
      '  OxyFr Flg      Vol   Moles(Gas)\n']);
fprintf(fid,['%%----------  ------  ---- -----  -------   ------  ----- -----'...
      ' ------ ---  -------- --------\n']);
fprintf(fid,'%%\n');

for ii=1:length(yr),
  fprintf(fid,sfmt, ...
      yr(ii),mn(ii),dy(ii),cyl(ii),irun(ii),char(gas(ii)),...
      htvac(ii),htsmp(ii),mencor(ii),...
      temp(ii),ofr(ii),flag(ii),...
      Smlvolco2(ii),molesCo2(ii),char(scom(ii)));
end
fclose(fid);

iquit=0;

return


%%%%%%%%%%%%%%%%%%%%%%%%%
function [htvac,htsmp,temp]=uncertadj(htvac,htsmp,temp);
% Uncertainty analysis - adjust the heights, temps
%

% directly imopacts mole fract
%htvac=htvac+0.1;
%temp=temp+0.01;

return
```

Source Code 2 Matlab cdmncmmtotalgas.m

```
function iquit=cdmncmmtotalgas(icor,icormen);
% Calculates total moles of gas in 5L chamber
%
% Input:
%  input/CMMtotalgas.dta'
%
% Output:
%  output/cmmtotalgas.csv';
%
MFILE=upper(mfilename);

if nargin<1,
  error('Need ICOR');
end
if nargin<2,
  error('Need ICORMEN');
end

iquit=1;
```

```
% Read totalgas column data
%
fname='input/CMMtotalgas.dta';
[T1,cyl,irun,gas,mencor1,mencor2,i1,htvac,htsmp,temp,ofr,sflag,scom,lcom]=...
    cdmnreadcmmco2(fname);


% Apply stepwise meniscor correction
%
if any(icormen==[1 2]),
  mencor2=cdmnmenisccor(T1,cyl,mencor2,1,icormen);
end

% Uncertainty analysis - adjust the heights, temps
%
[htvac,htsmp,temp]=uncertadj(htvac,htsmp,temp);

% Correct heights
%
ilrg=1;
[htvac]=cdmnmanocor(htvac,ilrg,icor);
[htsmp]=cdmnmanocor(htsmp,ilrg,icor);

% Convert flag to float
%
flag=ones(size(T1));
I=strmatch('00',sflag);
flag(I)=0;

% Apply temperature correction at times T1
%
temp=cdmntempcor(temp,T1);

% Read Virial coefficients
%
Vircoef=virials('air',temp);

I=strmatch('sair',lower(gas));
Vircoef(I)=virials('sair',temp(I),ofr(I));

I=strmatch('n2',lower(gas));
Vircoef(I)=virials('n2',temp(I));

% Look up large chamber volume at each time T1
%
Lrgvolgas=plnvols(T1,cellstr(meshgrid('5000',T1)));

% Density of mercury
%
Rhohgn=rhohg(temp);

% Calculate total moles of gas, equation (1) of 2002 manometry report
%
presn2 =(htvac-htsmp+mencor2).*Rhohgn*stdConst('gravconst')/10;
step2=1+(4*presn2.*Vircoef)./(stdConst('gasconst').*(temp+stdConst('tk0c')));
molesGas=(-Lrgvolgas./(2.0*Vircoef)).*(1.0-sqrt(step2));


% Write results
%
fname='output/cmmtotalgas.csv';

fid=fopen(fname,'w');
if fid<1,
  fprintf(2,' %s: Couldn''t open %s\n',MFILE,fname);
  return
end
fprintf(2,' %s: Writing to %s\n',MFILE,fname);

fprintf(fid,'%%\n');
fprintf(fid,'%%\n');
fprintf(fid,['%%    Date    number   no   gas    (mm)      (mm)    (mm)  Temp'...
      '  OxyFr Flg      Vol   Moles(Gas)\n']);
fprintf(fid,['%%---------  ------  ---- -----  -------   ------  -----  ----- -----'...
      ' ------ ---  ------- --------\n']);
fprintf(fid,'%%\n');

sfmt=['%4d-%2.2d-%2.2d, %6d, %4d, %4s, %7.3f, %7.3f, %5.3f, %5.2f, '...
      '%5.3f, %1d, %8.5f, %11.8f, %s\n'];
```

```
[yr,mn,dy]=datevec(T1);

for ii=1:length(yr),
  fprintf(fid,sfmt, ...
      yr(ii),mn(ii),dy(ii),cyl(ii),irun(ii),char(gas(ii)),...
      htvac(ii),htsmp(ii),mencor2(ii),...
      temp(ii),ofr(ii),flag(ii),...
      Lrgvolgas(ii),molesGas(ii),char(scom(ii)));
end

fclose(fid);

iquit=0;

return

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

function [htvac,htsmp,temp]=uncertadj(htvac,htsmp,temp);
% Uncertainty analysis - adjust the heights, temps
%

%htvac=htvac+0.1;


return
```

Source Code 3 Matlab cdmnmolefract.m

```
function iquit=cdmnmolefract
% Given number of moles of carbon dioxide and total gas,
% Calculates mole fraction of CO2 in total gas
%
% Input:
%  output/cmmco2.csv';
%  output/cmmtotalgas.csv';
%
% Output:
%  output/cmmmolefract.csv
%  output/cmmmolefract_id.csv
%
MFILE=upper(mfilename);

iquit=1;


% Read number of moles of CO2 in small 4cc chamber
% Calculated in cdmncmmco2.m
%
fname='output/cmmco2.csv';
[T1C,cylC,runC,gasC,htvacC,htsmpC,tempC,ofrC,flagC,volC,molesC,mencorC,...
      scomC]=cdmnreadgas(fname);


% Read total number of moles of gas in large volume
% Calculated in cdmncmmtotalgas.m
%
fname='output/cmmtotalgas.csv';
[T1T,cylT,runT,gasT,htvacT,htsmpT,tempT,ofrT,flagT,volT,molesT,mencorT,...
      scomT]=cdmnreadgas(fname);

% Check for non existant data
%
if isempty(T1T) | isempty(T1C),
  return
end




% Build arrays to store output parameters for each input CO2 run
%
molefrac=NaN*T1C;
flag    =11*ones(size(T1C));
n2oconc =zeros(size(T1C));
molesTm =NaN*T1C;
```

```
tempTm  =molesTm;
volTm   =molesTm;
htvacTm =molesTm;
htsmpTm =molesTm;
mencorTm=molesTm;


% Read the N2O content for each cylinder
%
cyln2o=load('input/cyln2o.txt');

[yr,mn,dy]=datevec(T1C);

% Loop through each CO2 gas measurement, match with Total Gas measurement
%
for ico2=1:length(T1C),

  % Match Unflagged cylinder ID & Run number
  % Failing that, include flagged data
  %
  I=find(cylT==cylC(ico2) & runT==runC(ico2) & flagT==0);
  if isempty(I),
    % Include flagged data
    I=find(cylT==cylC(ico2) & runT==runC(ico2));
  end

  if length(I)>0,

    % Correct cylinder for N2O
    %
    IN=find(cylC(ico2)==cyln2o(:,1));
    if isempty(IN),
      n2oconc(ico2)=0;
    else
      n2oconc(ico2)=cyln2o(IN,2);
    end


    % Save average Total Gas numbers
    %
    molesTm(ico2) =mean(molesT(I));
    tempTm(ico2)  =mean(tempT(I));
    volTm(ico2)   =mean(volT(I));
    htvacTm(ico2) =mean(htvacT(I));
    htsmpTm(ico2) =mean(htsmpT(I));
    mencorTm(ico2)=mean(mencorT(I));
    if length(I)>1,
      fprintf(2,' %s: Averaging %d Total Air Meas. for cyl %d run %d\n',...
  MFILE,length(I),cylC(ico2),runC(ico2));
    end

    molefrac(ico2)=(molesC(ico2)/molesTm(ico2))-n2oconc(ico2); %-n2oconc

    % Combine flags
    %
    flag(ico2)=10*flagC(ico2)+max(flagT(I));
  end
end




% Define output file format
%
sfmt=['%4d-%2.2d-%2.2d,%7d,%4d, %4s, %6.4f, %6.3f, %5.2f, %5.2f,'...
    ' %7.3f, %7.3f, %7.3f, %7.3f, %+5.3f, %+5.3f, %2.2d, %11.8f, %10.8f,' ...
    ' %4.2f,%9.4f, %s\n'];


% Open results output file
%
fname='output/cmmmolefract.csv';
fid=fopen(fname,'w');
if fid<1,
  fprintf(2,' %s: Couldn''t open %s\n',MFILE,fname);
  return
end
fprintf(2,' %s: Writing to %s\n',MFILE,fname);
```

```
% Write the output file header
%
fprintf(fid,'%% Isotopic corrections have NOT been made to these data\n');
fprintf(fid,'%%\n');
fprintf(fid,['%%     Date,    cyl, Run,  Gas,  Vol-C,    Vol-T,'...
      ' Tem-C, Tem-T,  HtVacC,  HtVacT,  HtSmpC,  HtSmpT,'...
      'mencorC,mencorT, Flag,   moles-C,    moles-T,   N2O,   mfrac, Com\n']);
fprintf(fid,'%%\n');

for ico2=1:length(T1C),

  fprintf(fid,sfmt,yr(ico2),mn(ico2),dy(ico2),...
      cylC(ico2),runC(ico2),char(gasC(ico2)),volC(ico2),...
      volTm(ico2),tempC(ico2),tempTm(ico2),...
      htvacC(ico2),htvacTm(ico2),htsmpC(ico2),htsmpTm(ico2), ...
      mencorC(ico2),mencorTm(ico2),...
      flag(ico2),molesC(ico2),molesTm(ico2),n2oconc(ico2),...
      molefrac(ico2),char(scomC(ico2)));
end
fclose(fid);



%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Re write data sorted by cylinder-ID
%
fname='output/cmmmolefract_id.csv';
fid2=fopen(fname,'w');
if fid2<1,
  fprintf(2,' %s: Couldn''t open %s\n',MFILE,fname);
  return
end
fprintf(2,' %s: Writing to %s\n',MFILE,fname);


% Write file header
%
fprintf(fid,'%% Isotopic corrections have NOT been made to these data\n');
fprintf(fid2,'%%\n');
fprintf(fid2,['%%     Date,    cyl,  M-Frac,    Dev,Flg, run,  Vol-C,    Vol-T,'...
      '  Tem-C, Tem-T,  HtVacC,  HtVacT,  HtSmpC,  HtSmpT,'...
      'Flag,  moles-C,    moles-T\n']);

% Sort into cylinder ID order
%
[cylC,IS]=sort(cylC);

[yr,mn,dy,runC,gasC,volC,tempC...
      ,htvacC,htsmpC,flag,flagC,molesC,molefrac,mencorC,n2oconc ...
      ,molesTm,tempTm,volTm,htvacTm,htsmpTm,mencorTm...
      ]=keeprows(IS,yr,mn,dy,runC,gasC,volC,tempC,...
    htvacC,htsmpC,flag,flagC,molesC,molefrac,mencorC,n2oconc ...
    ,molesTm,tempTm,volTm,htvacTm,htsmpTm,mencorTm...
    );


sfmt2=['%4d-%2.2d-%2.2d,%7d,%8.3f, %+7.3f, %2.2d,%4d, %4s, %6.4f, %6.3f,'...
      ' %5.2f, %5.2f, %7.3f, %7.3f, %7.3f, %7.3f, %+5.3f, %+5.3f, %11.8f,'...
      ' %10.8f, %4.2f\n'];

for ico2=1:length(T1C),

  % Calculate mean value for each cylinder
  %
  J=find(cylC==cylC(ico2) & flag==0);
  if isempty(J),
    Cmn=NaN;
  else
    Cmn=mean(molefrac(J));
  end

  fprintf(fid2,sfmt2,yr(ico2),mn(ico2),dy(ico2),...
      cylC(ico2),molefrac(ico2),molefrac(ico2)-Cmn,...
      flag(ico2),runC(ico2),char(gasC(ico2)),volC(ico2),volTm(ico2),...
      tempC(ico2),tempTm(ico2),...
      htvacC(ico2),htvacTm(ico2),htsmpC(ico2),htsmpTm(ico2), ...
      mencorC(ico2),mencorTm(ico2),...
      molesC(ico2),molesTm(ico2),n2oconc(ico2));
```

```
end
fclose(fid2);

iquit=0;

return
```

Source Code 4 Matlab virials.m

```
function virial=virials(Gastype,Tc,O2fr)
% Virial coefficient for CO2, O2, N2, Air
% Landolt-Bornstein
% Numerical Data and Functional Relationships in Science and Technology
% New Series/Editor in Chief: W. Martienssen
%
% equations from: "Virial Coefficients of Pure Gases and Mixtures",
% Subvolume A  Virial Coefficients of Pure Gases
% J.H. Dymond, et al
%

Tk0=stdConst('tk0c');
TK=Tc+Tk0;

if strcmp(Gastype,'co2'),
  virial=+5.7400*10-3.88290*10^04./(TK)+4.2899*10^05./(TK).^2-1.4661*10^9./(TK).^3; % B/cm3
end

if strcmp(Gastype,'n2' ),
  virial=+4.0286*10-9.33780*10^03./(TK)-1.4164*10^06./(TK).^2+6.1253*10^7./(TK).^3-2.7198*10^9./(TK).^4;  % B/cm3
end

if strcmp(Gastype,'o2' ),
  virial=+4.2859*10-1.76960*10^04./(TK)+5.2007*10^05./(TK).^2-1.6393*10^8./(TK).^3+5.0855*10^9./(TK).^4;  % B/cm3
end

if strcmp(Gastype,'air' ),
  virial=polyval([-0.0008780872378   0.7192905979421  -144.4593279778207],TK);
end

if strcmp(Gastype,'sair' ),
  virialn=+4.0286*10-9.33780*10^03./(TK)-1.4164*10^06./(TK).^2+6.1253*10^7./(TK).^3-2.7198*10^9./(TK).^4;  % B/cm3

  virialo=+4.2859*10-1.76960*10^04./(TK)+5.2007*10^05./(TK).^2-1.6393*10^8./(TK).^3+5.0855*10^9./(TK).^4;  % B/cm3

  virial=O2fr.*virialo + (1-O2fr).*virialn;
end

%Last "if" above: virials for co2 free air from 'Sengers,et al March 1971

return
```

Source Code 5 Matlab rhohg.m

```
function rho=rhohg(temp)
% Density of Mercury
%
%Peter Guenther internet research on hg rho. Today's: Sept. 12, 2008
%valid from -20 to 300 degrees C
%'Density of Mercury - measurements and reference values'
%by H. Bettin and H. Fehlauer
%Metrologia 41 pp s16-s23. 2004

rho0=13595.0828;            %density of hg at 0 degrees C
a0=1.815868e-4;
a1=5.4583e-9;
a2=3.4980e-11;
a3=1.5558e-14;

a4=(1+(a0*temp+a1*temp.^2+a2*temp.^3+a3*temp.^4));

rho=rho0./a4;  rho=rho*1e-3;

return
```

Source Code 6 Matlab stdConst.m

```
function const=stdConst(name)
% Standard constants
%
if strcmp(name,'tk0c');      const=273.15;      end;
if strcmp(name,'bouywt');    const=0.99985;     end;
if strcmp(name,'gravconst'); const=979.537;     end;
if strcmp(name,'gravconst45'); const=980.665;   end;
if strcmp(name,'gconst');    const=62363.8;     end;
%Gas constant from "The 2002 CODDATA Recommended Values of the
%the Fundamental Physical Constants" Rev.Mod.Phys. 77,1,2005
%see also http://physics.nist.gov/constants

%if strcmp(name,'gasconst');  const=8.31436e+07; end; % Old
if strcmp(name,'gasconst');  const=8.314472e+07; end; % New
if strcmp(name,'pa2torr');   const=7.500616e-4; end;

return
```

Source Code 7 Matlab cdmntempcor.m

```
function to=cdmntempcor(TempIn,TimeIn)
% Apply temperature correction to allow fo mercury thermometer time drift
%
% to=cdmntempcor(TempIn,TimeIn)
%

XL=[
  1900 01 01 -0.01
  1961 05 31 -0.01
  2006 05 12 -0.11
  2106 01 01 -0.11
  ];

Timei =datenum(XL(:,1),XL(:,2),XL(:,3));
dTempi=XL(:,4);

% Interpolate temperature correction between above limits
%
dt=interp1(Timei,dTempi,TimeIn);

% Add temperature correction
%
to=TempIn+dt;

return
```

Source Code 8 FORTRAN corr6.F

```
c=============================================================================
c                                                                        CORR5
c co2-in-air gas mixtures corrections for 2012 scale

      subroutine corr6(dayn, fj, xin)

# include "cal.h"

C Prior to 1970, no correction to X scale
C
      if(dayn.lt.CD70) then
         return
      endif

C From 1970 to 1983, linearly increase correction to 0.02ppm
C
      if(dayn.lt.CD83) then
         xin=xin + 0.02*(dayn - CD70)/(CD83 - CD70)
         return
      endif
```

```
C From 1983 to 1985 linearly interpolate between the 0.02ppm corrected 1983
C values and the new 1985 values
C
      if(dayn.le.CD85) then
        x83 = ACUB83(fj)
        x83 = x83*1.000503    ! efs added 26Jan2000: as in VAX CAL99
        x83 = x83+.02;
        x85 = ACUB85(fj)
        xin = (x85*(dayn-CD83) + x83*(CD85-dayn))/(CD85 - CD83)
        return
      endif

      return
      end
c=======================================================================
```

Source Code 9 FORTRAN n2cubics12.f

```
C        21-Dec-2015 16:05:13
C
C  Section of the file with cubics since 1985 written automatically using matlab script
C   /home/matlab/CDRGMANO/cdmncalccubic.m
C   as a part of the manometry workup functions
C
C The new cubic coefficients are obtained from fits of the time-varying manometric
C  tank values and J-values obtained on the APC
C Cubic coefficients are stored in $MANO/output/cubics_n2.csv
C Cubic coefficients prior to 1985 have been retained from previous routines.
C Cubic coefficients from 1985 on are from matlab workup that includes
C  temperature and plenum drifts.
C
C X scale modifications prior to 1985 are added in new corr?.F routines
C  after cubics have been applied
C
C White stripe drift is obtained from single linear fit to concentrations vs time
C
C White stripe concentrations are held constant past last measured value
C
C Cathatometer corrections are NOT applied
C
C
c=============================================================================
c                                                                        CUB60
c  CUBIC FUNCTION FOR CO2-IN-N2

      function CUB60(a60)
      dj  = 0.576 - 0.005011*a60
      a74 = a60 + dj
      CUB60 = CUB74(a74)
      return
      end
c=============================================================================

c=============================================================================
c                                                                        CUB74
C  CUBIC FUNCTION FOR CO2-IN-N2

      function CUB74(a74)
      CUB74 = 77.455 + a74*(0.573302 +
     :                a74*(3.5735E-04 + 6.7618E-07*a74))
      return
      end
c=============================================================================

c=============================================================================
c                                                                        CUB80
C  CUBIC FUNCTION FOR CO2-IN-N2

      function CUB80(a80)
      CUB80 = 84.370 + a80*(0.542223 +
     :                a80*(4.2284E-04 + 5.8862E-07*a80))
      return
      end
c=============================================================================

c=============================================================================
c                                                                       CUB80I
```

```
C  CUBIC FUNCTION FOR CO2-IN-N2

      function CUB80I(x)
      aj = x
      do i = 1, 100
        xx = CUB80(aj)
        if(ABS(xx-x) .lt. .001) go to 20
        aj = aj - xx + x
      enddo
      write(*,'(A,E14.6)')
     :   ' Inverse of 1980 cubic did not converge, X = ', x

   20 CUB80I = aj
      return
      end
c=======================================================================

c=======================================================================
c                                                                  CUBQ80
C  CUBIC FUNCTION FOR CO2-IN-N2
C  THIS FIT INCLUDES QUARTERLY RUNS ON THE NEW N2 MANOS AROUND 1980

      function CUBQ80(a80)
      CUBQ80 = 84.776 + a80*(0.537732 +
     :                       a80*(4.3849E-04 + 5.7171E-07*a80))
      return
      end
c=======================================================================

c=======================================================================
c                                                                   CUB83
c  CUBIC FUNCTION FOR CO2-IN-N2

      function CUB83(a83)
      CUB83 = 86.946 + a83*(0.537883 +
     :                 a83*(3.8471E-04 + 6.8562E-07*a83))
      return
      end
c=======================================================================

c=======================================================================
c                                                                  CUB83I
c  CUBIC FUNCTION FOR CO2-IN-N2

      function CUB83I(x)
      aj = x
      do i = 1, 100
        xx = CUB83(aj)
        if(ABS(xx-x) .lt. .001) go to 20
        aj = aj - xx + x
      enddo
      write(*,'(A,E14.6)')
     :    ' Inverse of 1983 cubic did not converge, X = ', x

   20 CUB83I = aj
      return
      end
c=======================================================================
c
c=======================================================================
c Cubics since 1985 are from new manomtry including plenum and temperature drift
c=======================================================================
c
      function CUB85(a85)
      CUB85 = 87.12252 + a85*(5.371547e-01 +
     +         a85*(3.835221e-04 + 6.920529e-07*a85))
      RETURN
      END

c=========================================================
      function CUB87(a87)
      CUB87 = 88.95144 + a87*(5.216326e-01 +
     +         a87*(4.243131e-04 + 6.643967e-07*a87))
      RETURN
      END

c=========================================================
      function CUB89(a89)
      CUB89 = 86.42863 + a89*(5.433708e-01 +
     +         a89*(3.621534e-04 + 7.245729e-07*a89))
```

```
      RETURN
      END

c=======================================================
      function CUB90(a90)
      CUB90 = 87.25723 + a90*(5.297711e-01 +
     +         a90*(4.068671e-04 + 6.907996e-07*a90))
      RETURN
      END

c=======================================================
      function CUB93(a93)
      CUB93 = 82.34913 + a93*(5.587693e-01 +
     +         a93*(3.326840e-04 + 7.898281e-07*a93))
      RETURN
      END

c=======================================================
      function CUB95(a95)
      CUB95 = 86.38674 + a95*(5.361479e-01 +
     +         a95*(3.709918e-04 + 7.759689e-07*a95))
      RETURN
      END

c=======================================================
      function CUB97(a97)
      CUB97 = 89.27094 + a97*(5.162160e-01 +
     +         a97*(4.219203e-04 + 7.299140e-07*a97))
      RETURN
      END

c=======================================================
      function CUB99(a99)
      CUB99 = 87.33286 + a99*(5.349334e-01 +
     +         a99*(3.550203e-04 + 8.125953e-07*a99))
      RETURN
      END

c=======================================================
      function CUB01(a01)
      CUB01 = 85.27026 + a01*(5.366913e-01 +
     +         a01*(3.893994e-04 + 7.496177e-07*a01))
      RETURN
      END

c=======================================================
      function CUB03(a03)
      CUB03 = 85.75745 + a03*(5.478892e-01 +
     +         a03*(3.219045e-04 + 8.423599e-07*a03))
      RETURN
      END

c=======================================================
      function CUB05(a05)
      CUB05 = 85.35384 + a05*(5.435351e-01 +
     +         a05*(3.564250e-04 + 7.891543e-07*a05))
      RETURN
      END

c=======================================================
      function CUB08(a08)
      CUB08 = 85.35384 + a08*(5.435351e-01 +
     +         a08*(3.564250e-04 + 7.891543e-07*a08))
      RETURN
      END

c=======================================================
```

Source Code 10 FORTRAN aircubics12.f

```
C        21-Dec-2015 16:02:47
C
C  Section of the file with cubics since 1985 written automatically using matlab script
C   /home/matlab/CDRGMANO/cdmncalccubic.m
C   as a part of the manometry workup functions
C
C The new cubic coefficients are obtained from fits of the time-varying manometric
```

```
C  tank values and J-values obtained on the APC
C Cubic coefficients are stored in $MANO/output/cubics_air.csv
C Cubic coefficients prior to 1985 have been retained from previous routines.
C Cubic coefficients from 1985 on are from matlab workup that includes
C  temperature and plenum drifts.
C
C X scale modifications prior to 1985 are added in new corr?.F routines
C  after cubics have been applied
C
C White stripe drift is obtained from single linear fit to concentrations vs time
C
C White stripe concentrations are held constant past last measured value
C
C Cathatometer corrections are NOT applied
C
C
c============================================================================
c                                                                       ACUB83
c  CUBIC FUNCTIONS FOR CO2-IN-AIR

      function ACUB83(c83)
      ACUB83 = 88.579 + c83*(0.529183 +
     :                 c83*(4.4239E-04 + 6.5448E-07*c83))
      return
      end
c============================================================================
c
c============================================================================
c Cubics since 1985 are from new manomtry including plenum and temperature drift
c============================================================================
c
      function ACUB85(c85)
      ACUB85 = 88.00948 + c85*(5.356075e-01 +
     +         c85*(4.180136e-04 + 6.845174e-07*c85))
      RETURN
      END

c============================================================
      function ACUB87(c87)
      ACUB87 = 88.42135 + c87*(5.340588e-01 +
     +         c87*(4.155947e-04 + 6.993125e-07*c87))
      RETURN
      END

c============================================================
      function ACUB89(c89)
      ACUB89 = 86.15848 + c89*(5.533364e-01 +
     +         c89*(3.626204e-04 + 7.477943e-07*c89))
      RETURN
      END

c============================================================
      function ACUB90(c90)
      ACUB90 = 87.09348 + c90*(5.387758e-01 +
     +         c90*(4.100822e-04 + 7.114755e-07*c90))
      RETURN
      END

c============================================================
      function ACUB93(c93)
      ACUB93 = 79.66759 + c93*(5.927191e-01 +
     +         c93*(2.574362e-04 + 8.914217e-07*c93))
      RETURN
      END

c============================================================
      function ACUB95(c95)
      ACUB95 = 84.79060 + c95*(5.600486e-01 +
     +         c95*(3.241763e-04 + 8.520289e-07*c95))
      RETURN
      END

c============================================================
      function ACUB97(c97)
      ACUB97 = 89.42443 + c97*(5.229177e-01 +
     +         c97*(4.314111e-04 + 7.468497e-07*c97))
      RETURN
      END

c============================================================
```

```
      function ACUB99(c99)
      ACUB99 = 86.12232 + c99*(5.558808e-01 +
     +         c99*(3.182566e-04 + 8.769159e-07*c99))
      RETURN
      END

c=============================================================
      function ACUB01(c01)
      ACUB01 = 83.82635 + c01*(5.609054e-01 +
     +         c01*(3.409806e-04 + 8.274885e-07*c01))
      RETURN
      END

c=============================================================
      function ACUB03(c03)
      ACUB03 = 84.63584 + c03*(5.675993e-01 +
     +         c03*(2.875733e-04 + 9.075717e-07*c03))
      RETURN
      END

c=============================================================
      function ACUB05(c05)
      ACUB05 = 83.25163 + c05*(5.745997e-01 +
     +         c05*(2.819865e-04 + 8.986152e-07*c05))
      RETURN
      END

c=============================================================
      function ACUB08(c08)
      ACUB08 = 85.78396 + c08*(5.707623e-01 +
     +         c08*(2.587697e-04 + 9.421272e-07*c08))
      RETURN
      END

c=============================================================
      function ACUB12(c12)
      ACUB12 = 85.42566 + c12*(5.708368e-01 +
     +         c12*(2.597835e-04 + 9.473215e-07*c12))
      RETURN
      END

c=============================================================
```