Tisch Environmental, Inc.

TE-PNY1123 Mass Flow Controlled PUF High Volume Air Sampler

OPERATIONS MANUAL

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PREFACE

Tisch Environmental, Inc. is a third generation family owned business. The owners Wilbur J. Tisch and James P. Tisch have been involved in the High Volume Air Pollution field for the last 20 years. Started in March of 1998, they would like to welcome you to their company.

The intent of this manual is to instruct the user with unpacking, assembly, operating and calibration techniques. For information on air sampling principles, procedures and requirements please contact the local Environmental Protection Agency Office serving your area.

CONTENTS

INTRODUCTION

The TE-PNY1123 High Volume PUF Air Sampler is the recommended instrument for sampling large volumes of air for the collection of TSP (**T**otal **S**uspended **P**articulate) and PUF. The physical design of the sampler is based on aerodynamic principles which result in the collection of particles of 100 microns (Stokes Equivalent Diameter) and less. The TE-PNY1123 MFC PUF sampler consists of a TE-5001 Anodized Aluminum Shelter, TE-1004 PUF Aluminum Blower Motor Assembly, TE-5004 8"x10" Stainless Steel Filter Holder with probe hole, TE-5007 7-Day Mechanical Timer, TE-300-310 Mass Flow Controller, TE-5012 Elapsed Time Indicator and 6" round PUF spool piece.

APPLICATIONS

- Ambient air monitoring to determine suspended particulate levels relative to air quality standards.
- Impact of a specific source on ambient levels of suspended particulates by incorporating a "wind direction-activation" modification which permits the sampler to operate only when conditions are such that a source-receptor relationship exists.
- Monitoring of enclosed environments for relatively high levels of particulate matter, particularly toxic materials.
- Monitoring of emissions from large diameter vents where physical conditions preclude the use of conventional stack-testing equipment.

UNPACKING

1. Shelter Box – 46" x 22" x 21"   70 lbs

TE-PNY1123	Anodized Aluminum Shelter with mounted Flow Controller, 7-Day Mechanical Timer, Blower Motor Assembly, ETI, Exhaust Hose and 8WT manometer.
Envelope	with Manual

2. Lid Box – 19" x 14" x 14"   17 lbs

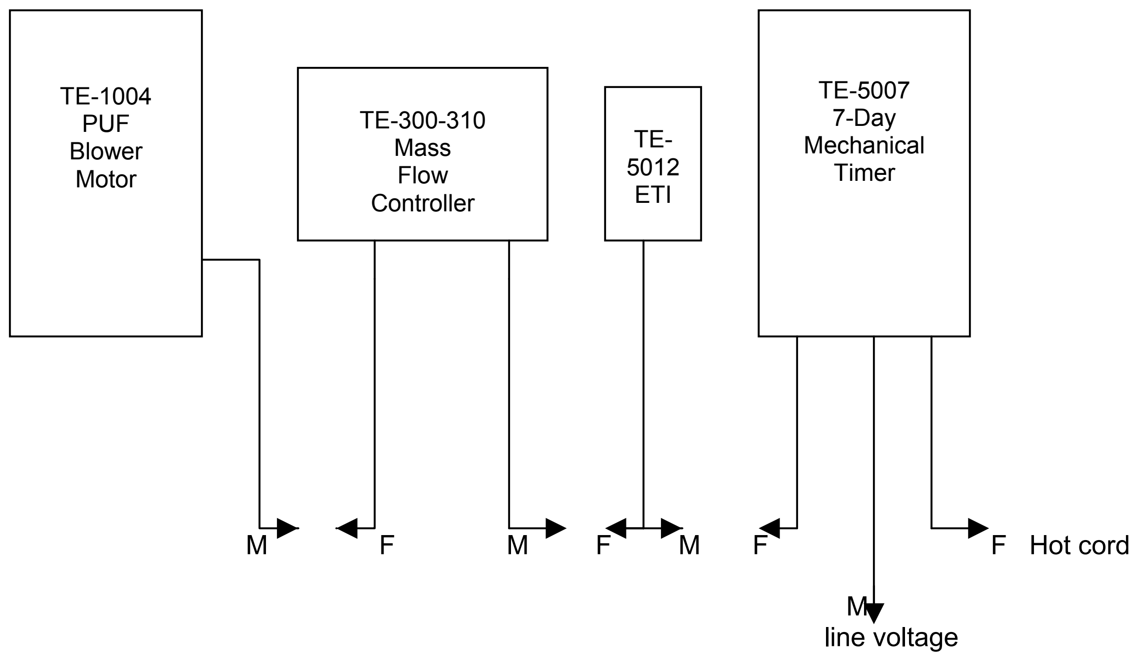
TE-5001-10	Gabled Roof
TE-5004	8" x 10" TSP Stainless Steel Filter Holder with probe hole
TE-5005-9	Filter Holder Gasket
TE-1123-1	6" Spool Piece with end caps

***** Save the shipping containers and packing material for future use.**

ASSEMBLY:

1. Open shelter box and remove Anodized Aluminum Shelter.
2. Take Exhaust Hose out of shelter and hook to side of TE-1004 PUF Blower Motor Assembly.
3. Open lid box. Enclosed in the 13" x 10" x 9" box is the TE-5004 Filter Holder with TE-5005-9 gasket and TE-1123-1 6" Spool Piece. Remove from boxes and remove 5001-10 Roof (for roof assembly see page 7).
4. Fill TE-5008 oil manometer mounted inside of shelter with red gauge oil, that is taped to top of manometer.
5. Screw TE-1123-1 Spool Piece onto TE-1004 Blower Motor Assembly, make sure gasket is in place.
6. Take Flow Controller probe and insert into filter holder collar, bring probe up through shelter and through top pan. Before tightening make sure probe slot is turned so air coming into filter holder goes through it.
7. Lower TE-5004 Filter Holder onto TE-1123-1 by lowering filter holder with probe down through top pan of shelter (again made sure gasket is in place). Tighten.
8. Connect tubing from pressure tap of blower motor to TE-5008 oil manometer.

ELECTRICAL HOOK-UP



The TE-1004 PUF Blower Motor male cord set plugs into the TE-300-310 Mass Flow Controller Female cord set.

The Mass Flow Controller male cord set plugs into the TE-5012 Elapsed Time Indicator female side.

The male side of the ETI cord set plugs into the TE-5007 7-Day Mechanical Timer timed female cord set which is on the left side of timer.

The other female cord set on timer (on the right) is hot all the time.

The male cord set of timer plugs into the line voltage.

GABLED ROOF ASSEMBLY

Lid parts bag contents (taped inside of lid):

5 pcs 10-24 x 1/2 pan head screws
5 pcs 10-24 stop nuts
1 pc   6-32 x 3/8 pan head screw
1 pc   6-32 hex nut
1 pc   20" chain with “S” hook
1 pc   TE-5001-10-9 roof back catch
1 pc   TE-5001-10-10 front catch
1 pc   TE-5001-10-11 rear lid hasp

1. Secure TE-5001-10-10 front catch to the shelter using 2 10-24 pan head screws with stop nuts.

2. Secure TE-5001-10-9 roof back catch to the back of shelter using 10-24 pan head screw with stop nut.

3. Secure TE-5001-10-11 rear lid hasp inside the lid with the slotted end angled up using 2 - 10-24 pan head screws with stop nuts.

   Note: These three items may need adjustment after the shelter lid is installed.

4. Remove 4 - 10-24 x 1/2 pan head screws from the nutserts in back of shelter.

5. Attach the lid to the shelter by placing the lid hinge plates on the **"OUTSIDE"** of the shelter top and tighten the 4 - 10-24 x 1/2 pan head screws into the nutserts.

6. Adjust the front catch to be sure that the lid slot lowers over it when closing the lid. The rear lid hasp should align with the roof back catch when the lid is open.

7. Attach the chain and "S" hook assembly to the side of the shelter with a 6-32 pan head screw and nut.

8. The lid can now be secured in an open or closed position with the "S" hook.

GENERAL CALIBRATION REQUIREMENTS

TE-PNY1123 MFC PUF High Volume Air Sampler should be calibrated:

1. Upon installation
2. After any motor maintenance
3. Once every quarter (three months)
4. After 360 sampling hours

CALIBRATION KIT

The two types of calibration kits available for the TE-PNY1123 MFC PUF High Volume Air Sampler are the TE-5025 and the TE-5028.

The TE-5025 utilizes five resistance plates to simulate various filter loading. The TE-5025 calibration kit includes: carrying case, 30" slack tube water manometer, adapter plate, 3' piece of tubing, TE-5025A orifice with flow calibration certificate, and 5 load plates (5,7,10,13,18).

The TE-5028 is the preferred method to calibrate the TE-PNY1123 MFC PUF High Volume Air Sampler. It simulates change in the resistance by merely rotating the knob on the top of the calibrator. The infinite resolution lets the technician select the desired flow resistance. The TE-5028 calibration kit includes: carrying case, 30" slack tube water manometer, adapter plate, 3' piece of tubing, and TE-5028A orifice with flow calibration certificate.

Each TE-5025A and TE-5028A is individually calibrated on a primary standard positive displacement device (Rootsmeter) which is directly traceable to NIST.

** It is recommended that each calibrator should be re-calibrated annually for accuracy and reliability.

CALIBRATION PROCEDURE

The following is a step by step process of the calibration of a **TE-PNY1123 Mass Flow Controlled PUF High Volume Sampling Systems.** Following these steps are example calculations determining the calibration flow rates, and resulting slope and intercept for the sampler. These instructions pertain to the samplers which have air flow controlled by electronic mass flow controllers (MFC) in conjunction with a manometer.

The Total Suspended Particulate samplers (TSP) are many times referred to as lead samplers as this is the primary duty given to these instruments in most cases. These instruments are suitable for capturing larger particulates such as heavy metals. Air monitoring studies that are concerned with smaller respirable particulate generally will call for the use of PM-10 particulate samplers which have a different calibration procedure. The TSP samplers have a very wide range of acceptable air flow operating limits, i.e., 1.10 to 1.70 m^3/min (39 to 60 CFM). A mass flow controller will sense a decrease in air flow and increases the voltage to the blower which increases the blower speed in order to compensate. This is necessary when sampling with a PM-10 sampler due to the narrow acceptable air flow range of these type of instruments.

The attached example calibration worksheets can be used with either a **TE-5025 Fixed Orifice Calibrator** which uses resistance plates to vary air flow or a **TE-5028 Variable Orifice Calibrator** which uses an adjustable or variable orifice. The attached worksheet uses a fixed orifice. Either type of orifice is acceptable for calibrating high volume samplers and the calibration process does not change with either type.

Proceed with the following steps to begin the calibration:

Step one: Disconnect the sampler motor from the mass flow controller. When calibrating the mass flow controller is not used. Plug motor into timed female on timer.

Step two: Mount the calibrator orifice and top loading adapter plate to the sampler. A sampling filter is generally not used during this procedure. Tighten the top loading adapter hold down nuts securely for this procedure to assure that no air leaks are present. Also, the 6" Spool Piece is usually empty during calibration but make sure of no leaks.

Step three: Turn unit on and allow the sampler motor to warm up to its normal operating temperature.

Step four: Conduct a leak test by covering the hole on top of the orifice and pressure tap on the orifice with your hands. Listen for a high-pitched squealing sound made by escaping air. If this sound is heard, a leak is present and the top loading adapter hold-down nuts need to be re-tightened.

Note: Avoid running the sampler for longer than 30 seconds at a time with the orifice blocked. This will reduce the chance of the motor overheating. Also, never try this leak test procedure with a manometer connected to the side tap on the calibration orifice or the blower motor. Liquid from the manometer could be drawn into the system and cause motor damage.

Step five: Connect one side of a water manometer to the pressure tap on the side of the orifice with a rubber vacuum tube. Leave the opposite side of the manometer open to the atmosphere.

Note: Both valves on the manometer have to be open for the liquid to flow freely also to read a manometer one side of the 'U' tube goes up the other goes down; add together this is the "H_2O

Step six: Insert the #18 resistance plate and gasket under the orifice **(TE-5025A)**, tighten the threaded collar securely, and record the manometer reading from the orifice and manometer reading from the sampler. A manometer must be held vertically to insure accurate readings. Repeat this procedure until the readings have been taken from all five resistance plates. If you are using a variable orifice **(TE-5028A)**, five flow rates are achieved in this step by adjusting the knob on the variable orifice to five different positions and taking five different readings.

Step seven: Record the ambient air temperature, the ambient barometric pressure, the sampler serial number, the orifice s/n, the orifice slope and intercept with date last certified, todays date, site location and the operators initials.

Step eight: Disconnect the sampler motor from its power source and remove the orifice and top loading adapter plate. Re-connect the sampler motor to the electronic mass flow controller.

An example of a Lead (or TSP) Sampler Calibration Data Sheet has been attached with data filled in from a typical calibration. This includes the transfer standard orifice calibration relationship which was taken from the Orifice Calibration Worksheet that accompanies the calibrator orifice. Since this calibration is for a TSP sampler, the slope and intercept for this orifice uses **standard** flows rather than actual flows and is taken from the Qstandard section of the Orifice Calibration Worksheet. The Qactual flows are used when calibrating a PM-10 sampler.

The five orifice manometer readings taken during the calibration have been recorded in the column on the data worksheet titled Orifice "H_2O. The five manometer readings from bottom of motor are recorded under the column titled FLOW (mano).

The orifice manometer readings need to be converted to the standard air flows they represent using the following equation:

Qstd = 1/m[Sqrt((H_20)(Pa/760)(298/Ta))-b]

where: Qstd = actual flow rate as indicated by the calibrator orifice, m^3/min
H_2O = orifice manometer reading during calibration, in. H_2O
Ta = ambient temperature during calibration, K (K = 273 + °C)
298 = standard temperature, a constant that never changes, K
Pa = ambient barometric pressure during calibration, mm Hg
760 = standard barometric pressure, a constant that never changes, mm Hg
m = *Qstandard slope of orifice* calibration relationship
b = *Qstandard intercept of orifice* calibration relationship

Once these standard flow rates have been determined for each of the five run points, they are recorded in the column titled Qa, and are represented in cubic meters per minute.

The five manometer reading from bottom of blower motor need to be converted to the current meteorological conditions using the following equation:

FLOW (corrected) = [Sqrt((H_2O)(Pa/760)(298/Ta))]

where: flow (corrected) = sampler manometer readings corrected to current Ta and Pa
H_2O = sampler manometer readings during calibration
Pa = ambient barometric pressure during calibration, mm Hg.
760 = standard barometric pressure, a constant that never changes, mm Hg
Ta = ambient temperature during calibration, K (K = 273 + °C)
298 = standard temperature, a constant that never changes, K

After each of the manometer readings have been corrected, they are recorded under the column titled FLOW (corrected).

Using Qstd and FLOW (corrected) as the x and y axis respectively, a slope, intercept, and correlation coefficient can be calculated using the least squares regression method. The correlation coefficient should never be less than 0.990 after a five-point calibration. A coefficient below .990 indicates a calibration that is not linear and the calibration should be performed again. If this occurs, it is most likely the result of an air leak during the calibration. The equations for determining the slope (m) and intercept (b) are as follows:

$$m = \frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}} \quad ; \quad b = \bar{y} - m\bar{x}$$

where: n = number of observations
$\bar{y} = \Sigma y/n$
$\bar{x} = \Sigma x/n$
Σ = sum of

The equation for the coefficient of correlation (r) is as follows:

$$r = \frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sqrt{\left[\sum x^2 - \frac{\left(\sum x\right)^2}{n}\right]\left[\sum y^2 - \frac{\left(\sum y\right)^2}{n}\right]}}$$

where: n = number of observations
Σ = sum of

The acceptable operating flow range of a TSP sampler is 1.1 to 1.7 m^3/min (39 to 60 CFM). Looking at the worksheet column Qstd, the flow rates that are within this range can be identified along with the manometer reading (Flow (mano)) that represents them. For instance if you wanted to set this sampler at 1.353 m^3/min (47.77 CFM) (Make sure the mass flow controller is plugged in and a filter is in place and your 6" Spool Piece is prepared) you would turn the Flow Adjustment screw until the manometer read 4.5 inches of H_2O. By making sure that the sampler is operating at a manometer reading that is within the acceptable range, it can be assumed that valid TSP data is being collected.

Example Problems

The following example problems use data from the attached calibration worksheet.

After all the sampling site information, calibrator information, and meteorological information have been recorded on the worksheet, standard air flows need to be determined from the orifice manometer readings taken during the calibration using the following equation:

1. **Qstd = 1/m[Sqrt((H_20)(Pa/760)(298/Ta))-b]**

where:
Qstd = actual flow rate as indicated by the calibrator orifice, m^3/min
H_2O = orifice manometer reading during calibration, in. H_2O
Ta = ambient temperature during calibration, K (K = 273 + °C)
298 = standard temperature, a constant that never changes, K
Pa = ambient barometric pressure during calibration, mm Hg
760 = standard barometric pressure, a constant that never changes, mm Hg
m = *Qstandard slope of orifice* calibration relationship
b = *Qstandard intercept of orifice* calibration relationship.

Note that the ambient temperature is needed in degrees Kelvin to satisfy the Qstd equation. Also, the barometric pressure needs to be reported in millimeters of mercury. In our case the two following conversions may be needed:

2. **degrees Kelvin = [5/9 (degrees Fahrenheit - 32)] + 273**
3. **millimeters of mercury = 25.4(inches of H_2O/13.6)**

Inserting the numbers from the calibration worksheet run point number one we get:

4. Qstd = 1/2.01[Sqrt((11.5)(737/760)(298/294)) - (-.02003)]
5. Qstd = .4975[Sqrt((11.5)(.9697)(1.0136)) + .02003]
6. Qstd = .4975[Sqrt(11.296) + .02003]
7. Qstd = .4975[3.361 + .02003]
8. Qstd = .4975[3.381]
9. Qstd = 1.682

Throughout these example problems you may find that your answers vary some from those arrived at here. This is probably due to different calculators carrying numbers to different decimal points. The variations are usually slight and should not be a point of concern.

With the Qstd determined, the corrected manometer reading (FLOW (corrected)) for this run point needs to be calculated using the following equation:

FLOW (corrected) = [Sqrt("H_2O)(Pa/760)(298/Ta)]
FLOW (corrected) = sampler manometer readings corrected to current Pa and Ta
“H_2O = sampler manometer reading during calibration
Pa = ambient barometric pressure during calibration, mm Hg.
760 = standard barometric pressure, a constant that never changes, mm Hg
Ta = ambient temperature during calibration, K (K = 273 + °C)
298 = standard temperature, a constant that never changes, K.

Inserting the data from run point one from the calibration worksheet (two manometers) we get::

10. FLOW (corrected) = [Sqrt(6.9)(737/760)(298/294)]

11. FLOW (corrected) = Sqrt(6.7822)

12. FLOW (corrected) = 2.6

This procedure should be completed for all five run points. EPA guidelines state that at least three of the five Qstd flow rates during the calibration be within or nearly within the acceptable operating limits of 1.10 to 1.70 m^3/min (39 to 60 CFM). If this condition is not met, the instrument should be recalibrated.

Using Qstd as our x-axis, and FLOW (corrected) as our y-axis, a slope, intercept, and correlation coefficient can be determined using the least squares regression method.

The equations for determining the slope (m) and intercept (b) are as follows:

$$m = \frac{\sum xy - \frac{\left(\sum x\right)\left(\sum y\right)}{n}}{\sum x^2 - \frac{\left(\sum x\right)^2}{n}} \quad ; \quad b = \bar{y} - m\bar{x}$$

where: n = number of observations
y = Σy/n
x = Σx/n
Σ = sum of

The equation for the coefficient of correlation (r) is as follows:

$$r = \frac{\sum xy - \frac{\left(\sum x\right)\left(\sum y\right)}{n}}{\sqrt{\left[\sum x^2 - \frac{\left(\sum x\right)^2}{n}\right]\left[\sum y^2 - \frac{\left(\sum y\right)^2}{n}\right]}}$$

where: n = number of observations
Σ = sum of.

Before these can be determined, some preliminary algebra is necessary. Σx, Σy, Σx^2, Σxy, $(\Sigma x)^2$, $(\Sigma y)^2$, n, y, and x need to be determined.

13. Σx = 1.684 + 1.532 + 1.353 + 1.08 + .851 = 6.5

14. Σy = 2.61 + 2.39 + 2.11 + 1.66 + 1.22 = 9.99

15. $\Sigma x^2 = (1.684)^2 + (1.532)^2 + (1.353)^2 + (1.08)^2 + (.851)^2 = 8.904$

16. $\Sigma y^2 = (2.61)^2 + (2.39)^2 + (2.11)^2 + (1.66)^2 + (1.22)^2 = 21.2203$

17. Σxy = (1.684)(2.61) + (1.532)(2.39) + (1.353)(2.11) + (1.08)(1.66) + (.851)(1.22) = 13.74257

18. n = 5

19. x = Σx/n = 1.3

20. y = Σy/n = 1.998

21. $(\Sigma x)^2 = (6.5)^2 = 42.25$

22. $(\Sigma y)^2 = (9.99)^2 = 99.8001$

Inserting the numbers:

23. slope = $$\frac{13.74257 - \frac{(6.5)(9.99)}{5}}{8.904 - \frac{42.25}{5}}$$

24. slope = $$\frac{13.74257 - \frac{(64.935)}{5}}{8.904 - \frac{42.25}{5}}$$

25. slope = $$\frac{13.74257 - 12.987}{8.904 - 8.45}$$

26. slope = $$\frac{.75557}{0.454}$$

27. slope = 1.6642511

28. intercept = 1.998 - (1.6642511)(1.3)

29. intercept = 1.998 - 2.1635264

30. intercept = -0.1655264

31. correlation coeff. = $$\frac{13.74257 - \frac{(6.5)(9.99)}{5}}{\sqrt{\left[8.904 - \frac{42.25}{5}\right]\left[21.2203 - \frac{99.8001}{5}\right]}}$$

32. correlation coeff. = $$\frac{13.74257 - \frac{(64.935)}{5}}{\sqrt{[(8.904 - 8.45)]\ [(21.2203 - 19.96002)]}}$$

33. correlation coeff. = $\dfrac{(13.74257 - 12.987)}{\sqrt{[(8.904 - 8.45)][(21.2203 - 19.96002)]}}$

34. correlation coeff. = $\dfrac{.75557}{\sqrt{(0.454)(1.26028)}}$

35. correlation coeff. = $\dfrac{.75557}{\sqrt{.5721671}}$

36. correlation coeff. = $\dfrac{.75557}{.7564172}$

37. correlation coeff. = $.9988799$

A calibration that has a correlation coefficient of less than .990 is not considered linear and should be re-calibrated. As you can see from the worksheet we have 3 Qstd numbers that are in the TSP range (1.1 - 1.7) and the correlation coeff. is > .990 , thus a good calibration.

TISCH ENVIRONMENTAL, INC.
TE-PNY1123 MFC SAMPLER CALIBRATION
(2 MANOMETERS)

Site

Location: Cleves, Ohio	Date: Jan. 01, 2003
Sampler: TE-PNY1123 MFC	Tech: Jim Tisch

Conditions

Sampler Elevation (Feet)	400	Corrected Pressure (mm HG)	737
Sea Level Pressure (in HG)	29.43	Temperature (deg K)	294
Temperature (deg F)	69	Corrected Seasonal (mm HG)	737
Seasonal SL Press. (in HG)	29.43	Seasonal Temp. (deg K)	294
Seasonal Temp (deg F)	69		

Calibration Orifice

Make: Tisch-Env	Qstd Slope: 2.01000
Model: TE-5025A	Qstd Intercept: -0.02003
Serial # 0005	Date Certified: Original

Calibration / **Linear Regression**

Plate or Test #	H2O (in)	Qstd (m3/min)	FLOW (mano)	FLOW (corrected)	Linear Regression
18	11.50	1.684	6.9	2.61	Slope = 1.6646
13	9.50	1.532	5.8	2.39	Intercept = -0.1684
10	7.40	1.353	4.5	2.11	Corr. coeff. = 0.9987
7	4.70	1.080	2.8	1.66	
5	2.90	0.851	1.5	1.22	

Calculations

H20 (in) = manometer on orifice
Qstd = 1/m [Sqrt (H20 (Pa/Pstd) (Tstd/Ta)) –b]
FLOW (mano) = manometer on blower motor port
FLOW (mano) = [Sqrt (in H20) (Pa/Pstd) (tstd/Ta)]
Qstd = standard flow rate
FLOW (corrected) = corrected flow reading

m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm HG)
Tstd = 298 deg K
Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

1/m ((Sqrt (in H20) (Pav/Pstd) (Tstd/Tav)) -b) (in H20) = manometer on blower motor port

m = sampler slope
b = sampler intercept
Tav = daily average temperature
Pav = daily average pressure

TOTAL VOLUME

TE-PNY1123 MFC PUF with TE-5008 Manometer

To figure out the total volume of air that flowed through the sampler during your sampling run take a set-up reading (when you set the sampler up manually turn it on and take a TE-5008 manometer reading; in our example it should be 4.5 inches of H_2O) and a pick-up reading (after the sample has been taken again manually turn sampler on and take a TE-5008 manometer reading; for our example let's say it read 4.3 inches of H_2O).

Take 4.5 + 4.3 = 8.8 8.8/2 = 4.4 so the 8WT manometer reading you would use is 4.4 . Put that into the formula (on bottom of worksheet):

1/m((Sqrt(in H_2O)(Pav/760)(298/Tav)) - b)

m	=	sampler slope
b	=	sampler intercept
in H_2O	=	average TE-5008 manometer reading
Tav	=	daily average temperature
Pav	=	daily average pressure
Sqrt	=	square root

Example:

m^3/min	=	1/1.6718((Sqrt(4.4)(298/294)(737/760))-(-0.1808))
m^3/min	=	.598 ((Sqrt(4.4)(1.01)(.97)) + 0.1808)
m^3/min	=	.598 ((Sqrt(4.311)) + 0.1808)
m^3/min	=	.598 ((2.076) + 0.1808)
m^3/min	=	.598 (2.257)
m^3/min	=	1.349
ft^3/min	=	1.349 x 35.31 = 47.63
Total ft^3	=	ft^3/min x 60 x hours that sampler ran

Let's say our sampler ran 23.3 hours (end ETI reading - start ETI reading)

** Make sure ETI is in hours otherwise convert to hours **

Total ft^3	=	47.63 x 60 x 23.3 = 66,586.74 ft^3
Total m^3	=	1.349 x 60 x 23.3 = 1885.90 m^3

SAMPLER OPERATION   TE-PNY1123 MFC PUF Sampler

1. After performing calibration procedure, remove filter holder frame by loosening the four wing nuts allowing the brass bolts and washers to swing down out of the way. Shift frame to one side and remove.

2. Carefully center a new filter, rougher side up, on the supporting screen. Properly align the filter on the screen so that when the frame is in position the gasket will form an airtight seal on the outer edges of the filter.

3. Secure the filter with the frame, brass bolts, and washers with sufficient pressure to avoid air leakage at the edges (make sure that the plastic washers are on top of the frame).

4. Wipe any dirt accumulation from around the filter holder with a clean cloth.

5. Close shelter lid carefully and secure with the "S" hook.

6. Open door. Unscrew 6" Spool Piece and insert prepared PUF of your choice.

7. Make sure all cords are plugged into their appropriate receptacles and the rubber tubing between the blower motor pressure tap and the TE-5008 manometer is connected (be careful not to pinch tubing when closing door).

8. Prepare the Timer as instructed on page 18.

9. Manually trip timer switch on to determine if sampler is operating properly.

10. Manually trip timer switch off. If the timer is set correctly you are ready to sample.

11. At the end of the sampling period, remove the frame to expose the filter. Carefully remove the exposed filter from the supporting screen by holding it gently at the ends (not at the corners). Fold the filter lengthwise so that sample touches sample. Unscrew 6" Spool Piece and collect sample.

12. It is always a good idea to contact the lab you are dealing with to see how they may suggest you collect the filter and the PUF and any other information that they may need.

TE-5007 7-Day Mechanical Timer

a. To set the "START" time, attach a (bright) "ON" tripper to the dial face on the desired "START" time. Tighten tripper screw securely.

b. To set the "STOP" time, attach a (dark) "OFF" tripper to the dial face on the desired "STOP" time. Tighten tripper screw securely.

c. To set current time and day, grasp dial and rotate clockwise only until correct time and day appear at time pointer.

MAINTENANCE

A regular maintenance schedule will allow a monitoring network to operate for longer periods of time without system failure. Our customers may find the adjustments in routine maintenance frequencies are necessary due to the operational demands on their sampler(s). We recommend that the following cleaning and maintenance activities be observed until a stable operating history of the sampler has been established.

TE-PNY1123 MFC PUF Sampler

1. Make sure all gaskets (including motor cushion) are in good shape and that they seal properly.
2. The power cords should be checked for good connections and for cracks (replace if necessary).

   CAUTION: Do not allow power cord or outlets to be immersed in water!

3. Inspect the filter screen and remove any foreign deposits.
4. Inspect the filter holder frame gasket each sample period and make sure of airtight seal.
5. Check or replace motor brushes every 500 hours.
6. Make sure elapsed time indicator is working properly.

MOTOR BRUSH REPLACEMENT   TE-PNY1123 MFC PUF Sampler-Brush
(Brush part #TE-33384)

CAUTION: Ensure that all electrical power to the TE-PNY1123 Sampler is disconnected prior to opening the motor housing. Unplug the motor power cord.

1. Remove the Motor Mounting Cover by removing the four bolts. This will expose the flange gasket and the motor. Turn motor over.

2. Remove ground wires from backplate and carefully lift the metal housing from the motor.

3. With a screwdriver carefully remove the plastic fan cover by prying in between brush and cover until both sides pop loose.

4. With a screwdriver carefully pry the brass quick disconnect tabs away from the expended brushes.

5. With a screwdriver remove brush holder and release **TE-33384** brushes.

6. With new **TE-33384** brushes, carefully slide quick disconnect tabs firmly into tab slot until seated.

7. Push brush carbon against commutator until plastic brush housing falls into place on commutator end bracket.

8. Replace brush holder clamps onto brushes.

9. Assemble motor after brush replacement: snap plastic fan cover back into place, feed ground wires back through backplate, put housing back on to motor, pull cord set back to normal postion, **** Make sure wires do not get smashed between metal ring and housing! **** fasten ground wires to backplate, turn motor over, tighten flange on top of housing and gasket.

   ****WARNING** Change Brushes Before Brush Shunt Touches Commutator !!**

MOTOR BRUSH SEATING PROCEDURE

CAUTION: Direct application of full voltage after changing brushes will cause arcing, commutator pitting, and reduce overall life.

To achieve best performance from new **TE-33384** brushes they must be seated on the commutator before full voltage is applied. After brush change apply 50% voltage for fifteen to twenty minutes to accomplish this seating. Use of **TE-300-310** Mass Flow Controller on system provides the reduced voltage for brush seating.