OPERATIONS MANUAL

TE-5200 TSP Tri-Pod

High Volume Air Sampler

Tisch Environmental, Inc.
145 South Miami Avenue
Village of Cleves, Ohio 45002

Toll Free: (877) 263 -7610 (TSP AND-PM10)
Direct: (513) 467-9000
FAX: (513) 467-9009

sales@tisch-env.com
www.tisch-env.com

TE-5200

Welcome

We are the experts in high volume air sampling, lead sampling, lead samplers, particulate monitoring, particulate emissions, pesticide monitoring, pesticide sampling, total suspended particles, particulate sampler, Federal Reference Method PM-10, Federal Reference Method PM2.5, EPA Method TO-4A, EPA Method TO-9A, EPA Method TO-13A. TEI is a family business located in the Village of Cleves, Ohio. TEI employs skilled personnel who average over 20 years of experience each in the design, manufacture, and support of air pollution monitoring equipment. Our modern well-equipped factory, quality philosophy and experience have made TEI the supplier of choice for air pollution monitoring equipment. Now working on the fourth generation, TEI has state-of-the-art manufacturing capability and is looking into the future needs of today's environmental professionals.

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Assistance

If you encounter problems or require detailed explanations, do not hesitate to contact Tisch Environmental offices by e-mail or phone.

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Introduction

EPA Standards

The following manual will instruct you in the unpacking, assemblage, operation, calibration, and usage of the corresponding Tisch Environmental product. For information on air sampling principles, procedures and requirements and to ensure compliance with government regulations please contact the local Environmental Protection Agency Office serving your area or visit www.epa.gov.

Safety Precautions

Before using Tisch Environmental products, always be sure to review the corresponding operations manuals and take all necessary safety precautions. Tisch Environmental products are to be used only for the purposes specified by operations manuals and by Tisch Environmental personnel. Tisch Environmental cannot guarantee the safe usage of its instruments in procedures that do not adhere to Tisch Environmental guidelines and standards. If you have concerns about the safety of your product or questions about safe practices, contact Tisch Environmental by phone or e-mail to speak with a representative.

Important Safety Instructions

Read and understand all instructions. Do not dispose of these instructions. Failure to follow all instruction listed in this manual may result in electric shock, fire, and/or personal injury. When using an electrical device, basic precautions must always be followed, including the precautions listed in the safety section of this manual. Never operate this unit in the presence of flammable materials or vapors are present as electrical devices may produce arcs or sparks that can cause fire or explosions. Always disconnect power supply before attempting to service or remove any components. Never immerse electrical parts in water or any other liquid. Always avoid body contact with grounded surfaces when plugging or unplugging this device is wet or dangerous conditions.

Electrical Installation

Installation must be carried out by specialized personal only, and must adhere to all local safety rules. This unit can be used for different power supply versions; before connecting this unit to the power line, always check if the voltage shown on the serial number tag corresponds to the one on your power supply. This product does use grounded plugs and wires. Grounding provides the path of least resistance for electrical currents, thereby reducing the risk of electric shock to users. This system is equipped with electrical cords with internal ground wires and a grounding plug. The plug must be plugged into a matching outlet that is properly installed and grounded in accordance with all local codes and ordinances. Do not modify the plug provided. If plug will not fit outlet, have the proper corresponding outlet installed by a professional, qualified electrician.

Do Not Abuse Cords

In the event that any electrical component of this system needs to be transported, **DO NOT** carry the unit by its power cord or unplug the unit by yanking the cord from the outlet. **Pull the plugs, not the cords**, to reduce risk of damage to unit. Keep all cords away from heat, oil, sharp objects, and moving parts.

Extension Cords

It is always advisable to use the shortest extension cord possible. Grounded units require a three-wire extension cord. As the distance from the supply outlet increases, you must use a heavier gauge extension cord. Using extension cords with inadequately sized wires results in serious changes in voltage, resulting in a loss of power and possible damage to equipment. It is recommended to only use 10-gauge extension cords for this product. Never use cords that exceed one hundred feet. Outdoor extension cords must be marked with the suffix “W-A” (or “W” in Canada)to indicate that it is suitable for outdoor usage. Always ensure that extension cords are properly wired and in good electrical condition. Always replace damaged extension cords immediately, or seek repair from qualified electricians before further use. Remember to protect extension cords from sharp objects, excessive heat, and damp or wet conditions.

Product Description

Introduction

The High Volume Air Sampler is the recommended instrument for sampling large volumes of air for the collection of TSP (Total Suspended Particulate). 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-5200 TSP Tripod consists of a TE-5002 Anodized Aluminum Tri-Pod Shelter, TE-5005 Aluminum Blower Motor Assembly, TE-5003 8”x10” Stainless Steel Filter Holder, TE-5030 30” Slack Tube Manometer, and TE-5010 Motor Voltage Control/Elapsed Time Indicator.

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.

Calibration Requirements

TE-5200 TSP Tripod High Volume Air Sampler should be calibrated:

Upon installation

- After any motor maintenance
- Once every quarter (three months)
- After 360 sampling hours

Calibration Kits

The TE-5028 is the preferred method to calibrate the TE-5200 TSP Tripod 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-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.**

Parts

1. Tri-Pod Shelter Box - 27" x 21" x 20" 36 lbs

Tri-Pod Pan
TE-5200 110volt, 60hz
TE-5200X 220volt, 50hz
TE-5200XZ 220volt, 60hz

Gabled Roof
TE-5001-10

Aluminum Blower Motor Assembly
TE-5005 110volt
TE-5005X 220volt

8”x10” Stainless Steel Filter Holder
TE-5003

30” Slack Tube Water Manometer
TE-5030

Motor Voltage Control/Elapsed Time Indicator
TE-5010 110volt, 60hz
TE-5010X 220volt, 50hz
TE-5010XZ 220volt, 60hz

2. Leg Box - 49" x 3" x 3" 7 lbs

3 pcs – Anodized Aluminum Legs
TE-5200-10

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

Assembly

1. Open both boxes and remove items.

2. Take the three anodized aluminum legs and insert into the leg holders on the tri-pod pan. Tighten the three thumbscrews to hold legs in place. Set unit upright.

3. Put filter holder down into opening of tri-pod pan and screw blower motor assembly onto it, gasket goes in between filter holder and blower motor assembly.

4. Take tri-pod shelter lid and fasten to back of tri-pod shelter pan using the 4 - 10/24 x ½" screws that are installed in the back of the pan. Make sure hinges are on outside of tri-pod shelter pan.

5. Take front catch piece and fasten to front of tri-pod shelter pan using 2 - 10/24 x ½" screws, which are taped inside of lid. The chain and "S" hook are used to keep lid closed by putting through front catch piece.

6. On front of tri-pod pan, hang 30" water manometer and motor voltage control/elapsed time indicator. Using instructions with manometer, prepare it with green distilled water. Connect tubing from blower motor assembly to the port on top of the 30" water manometer.

7. The blower motor assembly male cord set plugs into the female cord set of the motor voltage control/elapsed time indicator.

8. The motor voltage control/elapsed time indicator male cord set plugs into line voltage outlet. The motor will come on depending on what the voltage control pot is set at on front panel. To adjust voltage, take screwdriver and turn screw on control pot.

Operations

Calibration Worksheets

Calibration worksheets can be downloaded from our website, www.tisch-env.com. We recommend that you download the worksheet before following the procedure below.

Calibration Procedure

The following is a step by step process of the calibration of a **Model TE-5200 Tripod Total Suspended Particulate High Volume Sampling System.** Following these steps are example calculations determining the calibration flow rates, and resulting slope and intercept for the sampler.

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.

Proceed with the following steps to begin the calibration:

1. Mount the top loading adapter plate (TE-5035) on top of filter holder and tighten the hold down nuts securely to assure that no air leaks are present. Screw the calibration orifice (make sure the TE-5028A is wide open by turning black knob counter-clockwise) on to the top loading adapter plate. A sampling filter is generally not used during this procedure.

2. **Allow the sampler motor to warm up to its normal operating temperature. If TE-5010 Motor Voltage Control/Elapsed Time Indicator is plugged in it has to be unplugged so the Blower Motor is running wide open.**

3. Conduct a leak test by covering the holes on top of the orifice and pressure tap. 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.

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 sampler. Liquid from the manometer could be drawn into the system and cause motor damage.

4. 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.

5. Record the manometer reading from the orifice and the manometer reading from the sampler. A manometer must be held vertically to insure accurate readings (one side of the manometer goes up and one goes down, add both sides this is your H_2O (in)). Repeat this procedure by turning the orifice (TE-5028A) knob a little bit (this will cause more resistance) and taking both manometer readings. Do this until you have 5 sets of readings. Sometimes it is wise to take a few extra readings in case there is a problem with some of them. If you are using a fixed orifice (TE-5025A), five flow rates are achieved in this step by changing the different plates to change the resistance.

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

7. Disconnect the sampler motor from its power source and remove the orifice and top loading adapter plate.

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 Certificate that accompanies the calibration 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 Certificate. 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 H_2O (in). The five sampler manometer readings taken during the calibration have been 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_2O)(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 + ^oC)
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 Qstd, and are represented in cubic meters per minute.

The sampler manometer readings taken during the calibration need to be corrected 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 sampler manometer readings have been corrected, they are recorded in 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
$\bar{y} = \sum y/n$
$\bar{x} = \sum x/n$
$\sum$ = sum of.

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

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

where:
n = number of observations

$\sum$ = sum of

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:

Qstd = 1/m[Sqrt((H_2O)(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^o)
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 and it has to be at the site pressure.

The following conversions may be needed:

2. **degrees Kelvin = [5/9 (degrees Fahrenheit - 32)] + 273**
or degrees Kelvin = degrees Celsius + 273

3. **millimeters of mercury = 25.4 * (inches of Hg)**

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

4. Qstd = 1/1.47574[Sqrt((5.7)(757/760)(298/293)) - (-.00613)]

5. Qstd = .6776261[Sqrt((5.7)(.9960526)(1.0170648)) + .00613]
6. Qstd = .6776261[Sqrt(5.7771295) + .00613]
7. Qstd = .6776261[2.4035659 + .00613]
8. Qstd = .6776261[2.4096959]
9. Qstd = 1.632

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 flow reading (FLOW (corrected)) for this run point needs to be calculated using the following equation:

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

where:
FLOW (corrected) = sampler manometer readings corrected to standard
H_2O = sampler manometer readings during calibration
Pa = ambient barometric pressure during calibration, mm Hg.
760 = standard barometric pressure, mm Hg
Ta = ambient temperature during calibration, K (K = 273 + ^{o}C)
298 = standard temperature, K

Inserting the data from run point one on the calibration worksheet we get:

11. FLOW (corrected) = [Sqrt(5.4)(757/760)(298/293)]
12. FLOW (corrected) = Sqrt(5.47047)
13. FLOW (corrected) = 2.3389035

This procedure should be completed for all five run points.

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:

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

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

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

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

where:
n = number of observations
$\sum$ = sum of

Before these can be determined, some preliminary algebra is necessary. $\sum x$, $\sum y$, $\sum x^2$, $\sum xy$, $(\sum x)^2$, $(\sum y)^2$, n, $\bar{y}$, and $\bar{x}$ need to be determined.

17. $\Sigma x = 1.632 + 1.529 + 1.483 + 1.435 + 1.316 = 7.395$
18. $\Sigma y = 2.34 + 2.21 + 2.15 + 2.07 + 1.94 = 10.71$
19. $\Sigma x^2 = (1.632)^2 + (1.529)^2 + (1.483)^2 + (1.435)^2 + (1.316)^2 = 10.991635$

20. $\Sigma y^2 = (2.34)^2 + (2.21)^2 + (2.15)^2 + (2.07)^2 + (1.94)^2 = 23.0307$

21. $\Sigma xy = (1.632)(2.34) + (1.529)(2.21) + (1.483)(2.15) + (1.435)(2.07) + (1.316)(1.94) = 15.90991$

22. $n = 5$

23. $\bar{x} = \Sigma x/n = 1.479$

24. $\bar{y} = \Sigma y/n = 2.142$

25. $(\Sigma x)^2 = (7.395)^2 = 54.686025$

26. $(\Sigma y)^2 = (10.71)^2 = 114.7041$

Inserting the numbers:

27.

$$slope = \frac{(15.90991) - \left(\frac{(7.395)(10.71)}{5}\right)}{10.991635 - \left(\frac{54.686025}{5}\right)}$$

28.

$$slope = \frac{(15.90991) - \left(\frac{79.20045}{5}\right)}{10.991635 - \left(\frac{54.686025}{5}\right)}$$

29.

$$slope = \frac{15.90991 - 15.84009}{10.991635 - 10.937205}$$

30. slope = 0.05443

31. slope = 1.2827484

32. intercept = 2.142 - (1.2827484)(1.479)

33. intercept = 2.142 – 1.8971848

34. intercept = 0.2448152

35. correlation coeff. = $$\frac{15.90991 - \frac{(7.395)(10.71)}{5}}{\sqrt{\left[10.991635 - \frac{54.686025}{5}\right]\left[23.0307 - \frac{114.7041}{5}\right]}}$$

36. correlation coeff. = $$\frac{15.90991 - \frac{(79.20045)}{5}}{\sqrt{[(10.991635 - 10.937205)]\quad[(23.0307 - 22.94082)]}}$$

37. correlation coeff. = $$\frac{(15.90991 - 15.84009)}{\sqrt{[(10.991635 - 10.937205)][(23.0307 - 22.94082)]}}$$

38. correlation coeff. = $$\frac{0.06982}{\sqrt{(0.05443)(0.08988)}}$$

39. correlation coeff. = $$\frac{0.06982}{\sqrt{.0048921}}$$

40. correlation coeff. = $$\frac{0.06982}{0.0699435}$$

41. correlation coeff. = .998

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 5 good Qstd numbers and the correlation coeff. is > .990 thus we have a good calibration.

Total Volume

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 manometer reading; in our example it should be 3.7 inches of H_2O) and a pick-up reading (after the sample has been taken again manually turn sampler on and take a manometer reading; for our example let's say it read 3.3 inches of H_2O).
Take 3.7 + 3.3 = 7.0 7.0/2 = 3.5 so the manometer reading you would use is 3.5 . 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 manometer reading
Tav	=	daily average temperature
Pav	=	daily average pressure
Sqrt	=	square root

Example:

m^3/min	=	1/1.2809((Sqrt(3.5)(298/294)(760/760))-(0.2458))
m^3/min	=	.780701 ((Sqrt(3.5)(1.0136054)(1)) - 0.2458)
m^3/min	=	.780701 ((Sqrt(3.5476189)) - 0.2458)
m^3/min	=	.780701 ((1.8835123) – 0.2458)
m^3/min	=	.780701 (1.6377123)
m^3/min	=	1.2785636
ft^3/min	=	1.2785636 x 35.31 = 45.14608
Total ft^3	=	ft^3/min x 60 x hours that sampler ran

Let's say our sampler ran 23.9 hours (end ETI reading - start ETI reading)

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

Total ft^3 = 45.145608 x 60 x 23.9 = 64,739.478 ft^3

Total m^3 = 1.2785636 x 60 x 23.9 = 1833.4602 m^3

Sampler Operation

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

3. 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.

4. 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).

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

6. To start TE-5200 TSP Tripod High Volume Air Sampler, plug male cord set from blower motor into female cord set of motor voltage control/elapsed time indicator. Plug male cord set from motor voltage control into line voltage. Turn control screw clock-wise to increase voltage to motor.

7. 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.

IMPORTANT: It is highly advisable to contact any labs that you are in cooperation with in order to receive advice on filter handling, sample collection, and other regulations that may be specific to the institute you are working with.

Troubleshooting

note: this is a general troubleshooting guide, not all problems may apply to every sampler

Problem	**Solution**
Brush Motor Won't Turn On	-Check Motor brushes(Change every 500 hours) -Check Motor(Should be replaced after 2 brush changes about 1500 hours) -Check power supply -Ensure that all electrical connections are secure -Make sure timer is on -Make sure flow controller(if applicable) is adjusted properly -Check for loose or damaged wires
Brushless Motor Won't Turn On	-Ensure that all electrical connections are secure -Make sure flow controller(if applicable) is adjusted properly -Check power supply -Make sure timer is on -Check for loose or damaged wires
Mechanical timer not working	-Make sure trippers are set properly -Make sure that trippers are not pressed against switch at start up, the timer need to rotate a few degrees before the trippers hit the switch -Check for loose or damages wires -Check power supply -Check electrical hook up diagram to ensure correct installation -Check Motor
Digital timer not working	-Check timer settings -Make sure current date and time are correct -Make sure power cords are properly connected -Check fuse on main PC board (F3) -Check Power Supply -Check Motor

Mass Flow Controller not working	-Make sure timer is on -Check Motor/Motor brushes -Make sure 8 amp breaker is not popped -Make sure flow probe is installed correctly -Check all electrical connections -Check power supply
Elapsed Time Indicator not working	-Check Power Supply -Check electrical connections
Voltage Variator with ETI not working	-Check Power Supply -Check Electrical Connections -Check Motor
Flow Rate Too Low	-Check for leaks -Check filter media placement -Ensure only one piece of filter paper is installed -Check Flow Controller -Check flow valve(TE-1000PUF samplers only) -Ensure proper voltage is being supplied -Check calibration
Chart Recorder not working	-Replace pen point -Make sure pen point is touching chart -Make sure pen point is on "0" -Make sure tubing from motor is in place -Check Power Supply -Check motor
Air Leaks	-Make sure all gaskets are in place -Make sure all connections are secure -Makes sure connections are not over tightened -Check for damaged components: Filter holder screen, gaskets, motor flanges

Maintenance and Care

A regular maintenance schedule will allow a monitoring network to operate for longer periods of time without system failure. Our customers may find that 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-5200 TSP Tri-Pod

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 an airtight seal.

5. Check or replace TE-33384 motor brushes every 400 to 500 running hours.

6. After replacing brushes two times, a new motor (TE-116311) must be used.

7. Make sure elapsed time indicator is working properly.

8. Make sure continuous flow recorder pen is still inking each time, tubing has no crimps or cracks, and that the door is sealed completely.

Motor Brush Replacement

(120v Brush part #TE-33384)
(220v Brush part #TE-33378)

CAUTION: Unplug the unit from any line voltage sources before any servicing of blower motor assembly.

The following steps are accompanied by pictures to aid your understanding of motor brush replacement procedures. **Please be aware that the pictures are standardized and may not match the equipment that you are using.** Motor brush removal and replacement does not change based on motor or brush type, so do not be confused if your equipment differs from what is pictured.

1. Remove the blower motor flange by removing the four bolts. This will expose the gasket and the motor.

2. Turn assembly on side, loosen the cord retainer and then push cord into housing and at the same time let motor slide out exposing the brushes.

3. Looking down at motor. There are 2 brushes, one on each side. Carefully pry the brass quick disconnect tabs (the tabs are pushed into end of brush) away from the expended brushes and toward the armature. Try to pry the tabs as far as you can without damaging the armature.

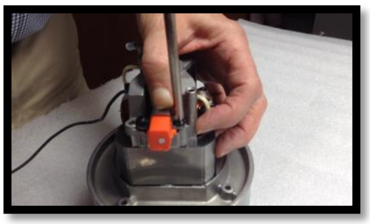
4. With a screwdriver loosen and remove brush holder clamps and release brushes. Carefully, pull quick disconnect tabs from expended brushes.

5. Carefully slide quick disconnect tabs into tab slot of new brush.

6. Push brush carbon against armature until brush housing falls into brush slot on motor.

7. Put brush holder clamps back onto brushes.

8. Make sure quick disconnect tabs are firmly seated into tab slot. Check field wires for good connections.



9. Assemble motor after brush replacement by placing housing over and down on the motor (at same time pull power cord out of housing), being careful not to pinch any motor wires beneath the motor spacer ring.

10. Secure power cord with the cord retainer cap.

11. Replace blower motor flange on top of motor making sure to center gasket.

****IMPORTANT**** To enhance motor life:

- Change brushes before brush shunt touches armature.
- Seat new brushes by applying 50% voltage for 10 to 15 minutes, the TE-5075 brush break in device allows for the 50% voltage.

TE-116311
110v Motor for TE-5200

TE-33384(green)
110v Motor Brush

TE-116312
220v Motor for TE-5200

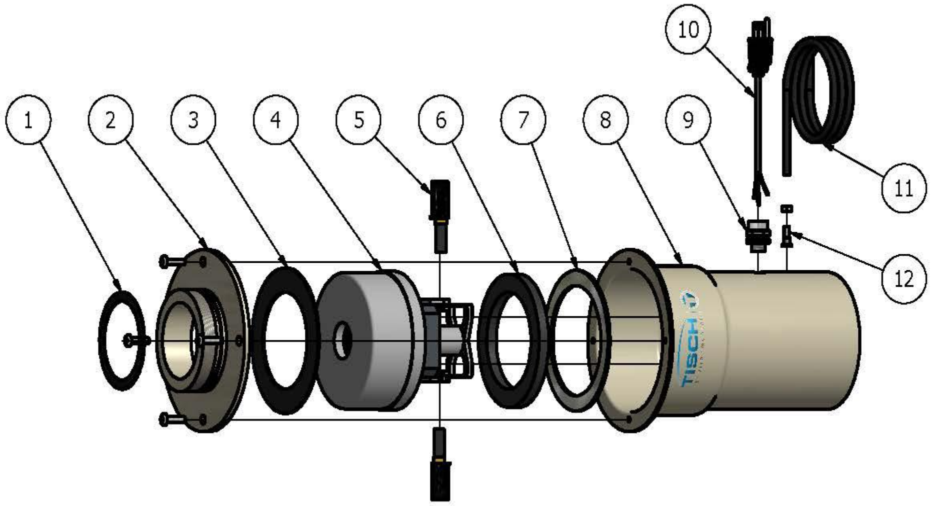
TE-33378(brown)
220v Motor Brush

Warranty

Instruments manufactured by Tisch Environmental, Inc. are guaranteed by warranty to be free of defects in materials and workmanship for one year after shipment from Tisch Environmental factories. The liability of Tisch Environmental, Inc. is limited to servicing or replacing any defective part of any instrument returned to the factory by the original purchaser. All service traceable to defects in original material or workmanship is considered warranty service and is performed free of charge. The expense of warranty shipping charges to and from our factory will be borne by Tisch Environmental. Service performed to rectify an instrument malfunction caused by abuse, acts of god or neglect, and service performed after the one-year warranty period will be charged to the customer at the current prices for labor, parts, and transportation. Brush-type and brushless motors will carry a warranty as far as the original manufacture will pass through its warranty to Tisch Environmental, Inc. The right is reserved to make changes in construction, design specifications, and prices without prior notice.

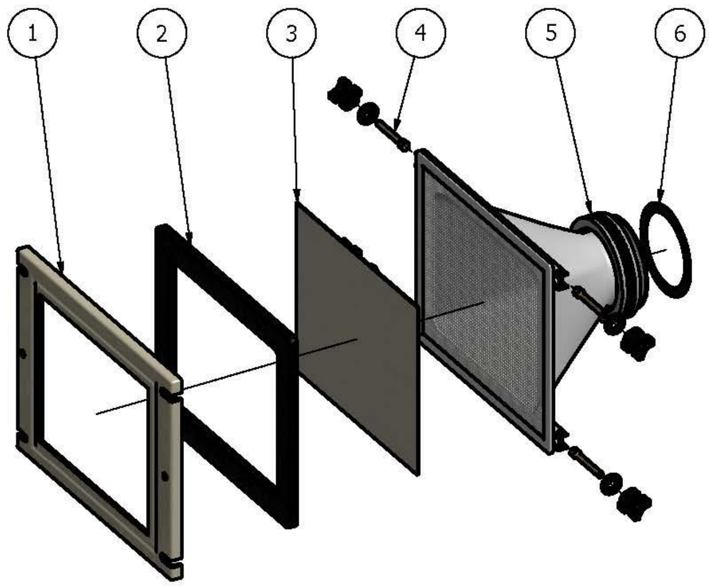
Assembly Drawings

TE-5005 Blower Motor



TE-5005 Brush Type Aluminum Blower Motor Assembly			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TE-5005-9	Filter Holder Gasket (between Filter Holder and Blower Motor)
2	1	TE-5005-1	Blower Motor Flange
3	1	TE-5005-2	Flange Gasket
4	1	TE-116311 TE-116312	Motor for 110V MFC Blower Motor for 220V MFC Blower
5	2	TE-33384 TE-33378	Motor Brushes for 110V Motor MFC Motor Brushes for 220V Motor MFC
6	1	TE-5005-4	Motor Cushion
7	1	TE-5005-5	Motor Spacer Ring
8	1	TE-5005-3	Aluminum Blower Motor Housing
9	1	TE-5005-7	Cord Retainer w/ Nut
10	1	TE-5010-4	Power Cord
11	1	TE-5005-6	Tubing 3 ft. Piece
12	1	TE-5005-8	Pressure Tap w/ Nut

TE-5003 Filter Holder



TE-5003 Filter Holder Assembly			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	TE-3000-2	Hold Down Frame
2	1	TE-5018	8" x 10" Gasket
3	1	N/A	Filter Paper
4	4	TE-5003-9	Plastic Thumb Nut, Brass Bolt, Washer, and Rivet
5	1	TE-5028-9	Aluminum Threaded Ring
6	1	TE-5005-9	Filter Holder Gasket (Between Filter Holder and Blower Motor)

Calibration Worksheet Sample

TE-5200 Calibration Worksheet

Site Information

Location:	Cleves Ohi	**Site ID:**	145	**Date:**	31-Oct-14
Sampler:	TE-5200	**Serial No:**	234	**Tech:**	Jim Tisch

Site Conditions

Barometric Pressure (in Hg):	29.80	**Corrected Pressure (mm Hg):**	757
Temperature (deg F):	68	**Temperature (deg K):**	293
Avg. Barometric Press. (in Hg):	29.92	**Corrected Average (mm Hg):**	760
Average Temp. (deg F):	70	**Average Temp. (deg K):**	294

Calibration Orifice

Make:	Tisch	**Qstd Slope:**	1.47574
Model:	TE-5028A	**Qstd Intercept:**	-0.00613
Serial#:	2978	**Calibration Due Date:**	24-Oct-15

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	Flow (mano)	Flow (corrected)	Linear Regression	
1	5.70	1.632	5.4	2.34	**Slope**	1.2809
2	5.00	1.529	4.8	2.21	**Intercept**	0.2458
3	4.70	1.483	4.6	2.15	**Corr. Coeff**	0.9994
4	4.40	1.435	4.3	2.07		
5	3.70	1.316	3.7	1.94	# of Observations:	5

Calculations

H2O (in) = manometer on orifice
Qstd = 1/m[Sqrt(H2O(Pa/Pstd)(Tstd/Ta))-b]
FLOW (mano) = [Sqrt(in H2O)(Pa/Pstd)(Tstd/Ta)]
FLOW (mano) = manometer on blower motor port
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)
For subsequent calculation of sampler flow:
1/m((Sqrt(in H2O)(298/Tav)(Pav/760))-b)
(in H2O) = manometer on blower motor port
NOTE: Ensure calibration orifice has been certified within 12 months of use

m = sampler slope
b = sampler intercept
Tav = daily average temperature
Pav = daily average pressure
Tstd = 298 deg K
Pstd = 760 mm Hg

Tisch Environmental 145 South Miami Ave, Cleves OH 45002 ● 877.263.7610 ● sales@tisch-env.com ● www.tisch-env.com

Calibration Certificate

TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVES, OH
45002
513.467.9000
877.263.7610 TOLL FREE
513.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5028A

Date - Oct 24, 2014 Rootsmeter S/N 9833620 Ta (K) - 296
Operator Tisch Orifice I.D. - 2978 Pa (mm) - 755.65

PLATE OR VDC #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.1880	4.5	1.50
2	NA	NA	1.00	0.9230	7.5	2.50
3	NA	NA	1.00	0.8380	9.0	3.00
4	NA	NA	1.00	0.7790	10.5	3.50
5	NA	NA	1.00	0.5860	18.0	6.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
0.9950	0.8375	1.2254		0.9940	0.8367	0.7665
0.9910	1.0737	1.5819		0.9901	1.0727	0.9896
0.9891	1.1803	1.7329		0.9881	1.1791	1.0840
0.9871	1.2671	1.8718		0.9861	1.2659	1.1709
0.9771	1.6674	2.4507		0.9761	1.6657	1.5331
Qstd slope (m) =		1.47574		Qa slope (m) =		0.92408
intercept (b) =		-0.00613		intercept (b) =		-0.00383
coefficient (r) =		0.99985		coefficient (r) =		0.99985
y axis = SQRT[H2O(Pa/760)(298/Ta)]				y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

Vstd = Diff. Vol[(Pa-Diff. Hg)/760](298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{[SQRT(H2O(Pa/760)(298/Ta))]- b}
Qa = 1/m{[SQRT H2O(Ta/Pa)]- b}