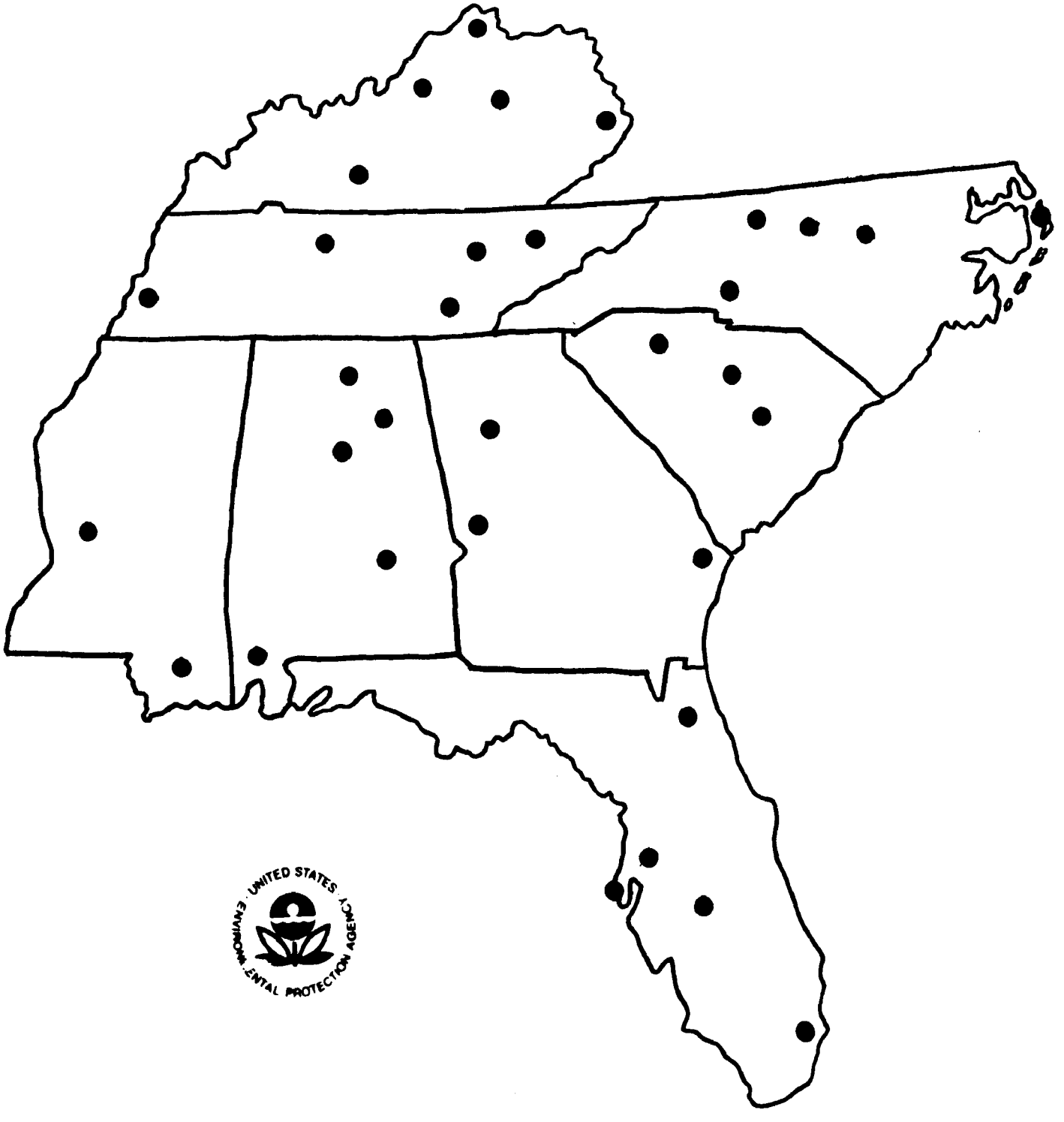
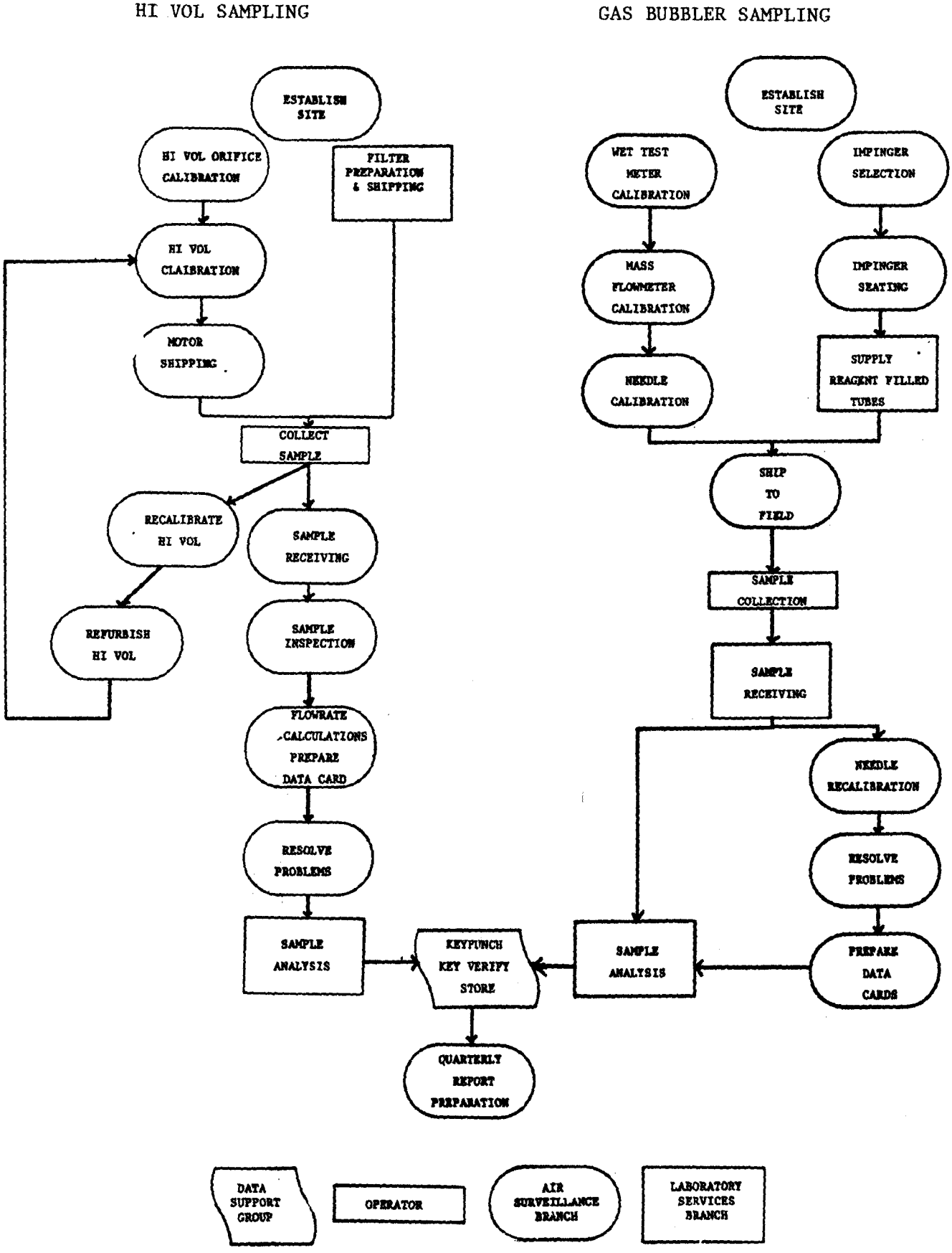
THE MONITORING AND FIELD SUPPORT ACTIVITY OF THE NATIONAL AIR SURVEILLANCE NETWORK

Standard Operating Procedures for EPA Region IV



U. S. Environmental Protection Agency
Surveillance and Analysis Division
Region IV

NASN FLOW DIAGRAM



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Standard Operating Procedures for EPA Region IV

U. S. Environmental Protection Agency
Surveillance and Analysis Division
Region IV
August 5, 1975

PREFACE

The National Air Surveillance Network (NASN) is a nationwide network of air pollution monitors used by the Environmental Protection Agency (EPA) for trends monitoring. EPA Region IV assumed the responsibility for that portion of the national program located within its jurisdiction on January 1, 1974.

In the absence of a formal standard operating procedure and schedules for calibration, preventative maintenance, and documentation, Region IV undertook this task as part of its quality assurance program. This Standard Operating Procedure is written, as nearly as possible, in a stepwise manner with a minimum of technical terms. Each portion of the procedure is explained in detail only once.

The purpose of this Standard Operating Procedure is to enable a high school graduate to have a two day general familiarization session and then use this document to operate the NASN. To ensure the technical accuracy, clarity, and completeness, these procedures have been tested, modified, and retested over an 18-month period. These procedures are not intended to be final. They will be modified as new methods and better information become available. At present, they are written for the General Metal Works [1] hi vol, Dayton timer, Research Appliance Corporation bubblers, and Dresser Industry's positive displacement meter.

This manual is not all inclusive in that it does not include the laboratory or data support group activities in a stepwise manner. Instead, these activities are shown where there is an interface with the monitoring and field support activity. The frontispiece is a flow diagram of the entire NASN activity as it relates to the monitoring and field support activity.

1/ Mention of a commercial product or private company name does not constitute endorsement by the U. S. Environmental Protection Agency.

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Section I
General Information

Section I

This section contains information used in both the hi vol and the gas bubbler networks regarding records, shipping, operation, and timers. It also includes information on the use of a barometer.

Records Index

This section introduces the record systems and files required for the NASN program. A detailed description of each record is contained in other sections where that function is performed.

Gas Sample Record Sheet File

A file of returned Gas Sample Record Sheets is maintained. The sheets are filed by sample period.

Hi Vol Calibration Log

The Hi Vol Calibration Log is for the entry of all data points obtained when a hi vol is calibrated. An example of the format is in the section on Hi Vol Calibration.

Hi Vol Orifice Calibration Curve File

A file of retired Hi Vol Orifice Calibration Curves is maintained. These are kept in chronological order.

Hi Vol Orifice Calibration Log

The Hi Vol Orifice Calibration Log is for the entry of all data points obtained when an orifice calibration set is calibrated on a positive displacement meter. An example of the format is in the section of Hi Vol Orifice Calibration.

Mass Flowmeter Calibration Log

The Mass Flowmeter Calibration Log is for the entry of all data points obtained when a mass flowmeter is calibrated. An example of the format is in the section on Mass Flowmeter Calibration.

NO_2 Needle Log

The NO_2 Needle Log is for the entry of the flowrates measured on needles designated for use in collecting NO_2 samples with gas bubblers. This log provides a history of each needle and its final disposition. These needles are abbreviated as "NO_2

needles". An example of the format is in the section on Needle Calibration.

Particulate Record Sheet File

A file of returned Particulate Record Sheets is maintained. The sheets are filed by sample period.

Property Logs

There are five (5) separate property logs used. A separate log is kept for hi vol motors, hi vol shelters, timers, bubbler shelters, and vacuum pumps. The purpose of these logs is to identify the location on any piece of equipment at any time it is in the field and the final disposition of the equipment. Each piece of equipment is marked with an assigned identification number.

The identification number consists of a six-digit number. The first digit is a "4" which designates EPA Region IV. The second and third digits are code numbers which identify the name of the piece of equipment. The last three digits are sequentially assigned numbers to identify the particular item in that series. An example of the Hi Vol Motor Property Log is illustrated in Figure 1.

	EPA Region Number	Item Type	Number in Series
Hi Vol Shelter	4	06	001 to 999
Hi Vol Motor	4	01	001 to 999
Vacuum Pump	4	03	001 to 999
Bubbler Box	4	04	001 to 999
Timer	4	05	001 to 999
Rotameter	4	02	001 to 999

Site Action Log

The Site Action Log is a site-by-site summary of every action taken in chronological order. Each State has a separate bound book in which is recorded every telephone contact, letter contact, equipment shipped and received, samples voided, site visits, etc.

Site Files

A file on each site is maintained to include SAROAD site identification forms, retired calibration curves, various evaluation forms, letter contacts, photographs, or any other loose copy that pertain to that site. These are kept in chronological order.

EPA Number: 4-01-061

Serial Number: 10639

	Date	Initials
Shipped to site 11 9999 001 Podunk Holler, Ga.	10/20/74	JWB
Received for refurbishment and recalibration	11/1/74	JWB
motor replaced	11/1/74	JWB

Figure 1
Hi Vol Property Log

SO_2 NEEDLE LOG

The SO_2 Needle Log is for the entry of the flowrates measured on needles designated for use in collecting SO_2 samples with the gas bubblers. This log provides a history of each needle and its final disposition. These needles are abbreviated as "SO_2 needles". An example of the format is in the section on Needle Calibration.

Timer Calibration Log

The Timer Calibration Log is for the entry of the times measured during timer calibration. An example of the format is in the section on Timer Calibration.

Wet Test Meter Calibration Log

The Wet Test Meter Calibration Log is for the entry of all data points obtained when a wet test meter is calibrated. An example of the format is in the section on Wet Test Meter Calibration.

TABLE 1

NASN SITE LOCATIONS

	AQCR NUMBER	TYPE SAMPLE	STATE AND CITY	SAROAD SITE NUMBER	PROJECT	SITE LOCATION
			ALABAMA			
1	4	HG	Birmingham	01 0380 003	01	720 South 20th Street
2	3	H	Gadsden	01 1480 001	01	Etowah Health Center Bldg
3	7	H	Huntsville	01 1860 001	01	Madison County Health Dept.
4	5	HG	Mobile	01 2380 001	01	Central Fire Station
5	2	HG	Montgomery	01 2460 001	01	515 West Jeff Davis Ave.
			FLORIDA			
6	52	HG	Hardee County *	10 1680 001	03	Pioneer Park, Zolfo Springs
7	49	HG	Jacksonville	10 1960 002	01	Hemming Park
8	50	HG	Miami	10 2700 002	01	864 NW 23rd Street
9	52	HG	St. Petersburg	10 3980 002	01	Pinellas Co. Health Dept.
10	52	HG	Tampa	10 4360 002	01	1105 East Kennedy Blvd.
			GEORGIA			
11	56	HG	Atlanta	11 0200 001	01	99 Butler St. SE
12	2	HG	Columbus	11 1280 001	01	Muscogee Co. Health Dept.
13	58	HG	Savannah	11 4500 001	01	City Hall - Bull & Bay Streets
			KENTUCKY			
14	103	H	Ashland	18 0080 002	01	21st and Front Streets
15	105	HG	Bowling Green	18 0320 001	01	Science & Technology Bldg.
16	79	HG	Covington	18 0800 001	01	7th and Scott Streets
17	102	HG	Lexington	18 2300 001	01	College of Pharmacy Bldg.
18	78	HG	Louisville	18 2380 002	01	2500 South Third Street
			MISSISSIPPI			
19	5	HG	Jackson	25 1260 002	01	R.E. Lee Building
20	5	HG	Jackson County*	25 2800 001	03	Gulf Coast Research Lab.
			NORTH CAROLINA			
21	167	HG	Charlotte	34 0700 001	01	600 East Trade Street
22	166	HG	Durham	34 1160 001	01	300 East Main Street
23	136	HG	Greensboro	34 1740 001	01	228 North Elm Street
24	136	HG	Winston Salem	34 4460 002	01	6th and Spruce Streets
25	168	HG	Cape Hatteras*	34 0590 001	03	Bodie Island Ranger Sta.
			SOUTH CAROLINA			
26	200	H	Columbia	42 0760 001	01	1600 Assembly Street
27	202	H	Greenville	42 1180 001	01	300 Elford Street
28	200	HG	Richland County*	42 1900 002	03	Sesqui. State Park
			TENNESSEE			
29	55	HG	Chattanooga	44 0380 001	01	100 East 11th Street
30	207	HG	Cumberland County*	44 0680 001	03	Lantana Fire Tower
31	18	HG	Knoxville	44 1740 002	01	617 Cumberland Ave.
32	7	HG	Memphis	44 2340 001	01	416 Alabama Ave.
33	208	HG	Nashville	44 2540 001	01	Metropolitan Court House

* Non-Urban Background

Legend:

H = Hi-Vol
G = Gas Bubbler
AQCR = Air Quality Control Region

Instrument Totals

H = 33
G = 28

Table 2
Gas Bubbler Shipping Schedule

The shipping schedule is designed to provide the cooperator with a mailing block at least one week before the scheduled sampling data. If the shipping schedule cannot be met, the mailing block should be shipped <u>before</u> the scheduled date as opposed to shipping <u>after</u> the scheduled mailing date.

1975

1st Quarter

Shipping Date			Sample Date		
Weekday	Month	Date	Weekday	Month	Date
Mon.	Dec.	23	Mon.	Jan.	6
Fri.	Jan.	3	Sat.	Jan.	18
Thur.	Jan.	16	Thur.	Jan.	20
Tues.	Jan.	28	Tues.	Feb.	11
Mon.	Feb.	10	Sun.	Feb.	23
Fri.	Feb.	21	Fri.	Mar.	7
Wed.	Mar.	5	Wed.	Mar.	19
Mon.	Mar.	17	Mon.	Mar.	31

2nd Quarter

Shipping Date			Sample Date		
Weekday	Month	Date	Weekday	Month	Date
Fri.	Mar.	28	Sat.	Apr.	12
Thur.	Apr.	10	Thur.	Apr.	24
Tues.	Apr.	22	Tues.	May	6
Mon.	May	5	Sun.	May	18
Fri.	May	16	Fri.	May	30
Wed.	May	28	Wed.	June	11
Mon.	June	9	Mon.	June	23

3rd Quarter

Shipping Date			Sample Date		
Weekday	Month	Date	Weekday	Month	Date
Fri.	June	20	Sat.	July	5
Thur.	July	3	Thur.	July	17
Tues.	July	15	Tues.	July	29
Mon.	July	28	Sun.	Aug.	10
Fri.	Aug.	8	Fri.	Aug.	22
Wed.	Aug.	20	Wed.	Sept.	3
Tues.	Sept.	2	Mon.	Sept.	15
Fri.	Sept.	12	Sat.	Sept.	27

4th Quarter

Shipping Date			Sample Date		
Weekday	Month	Date	Weekday	Month	Date
Thur.	Sept.	25	Thur.	Oct.	9
Tues.	Oct.	7	Tues.	Oct.	21
Mon.	Oct.	20	Sun.	Nov.	2
Fri.	Oct.	31	Fri.	Nov.	14
Wed.	Nov.	12	Wed.	Nov.	26
Mon.	Nov.	24	Mon.	Dec.	8
Fri.	Dec.	5	Sat.	Dec.	20

1976

1st Quarter

Shipping Date			Sample Date		
Weekday	Month	Date	Weekday	Month	Date
Thur.	Dec.	18	Thur.	Jan.	1
Tue.	Dec.	30	Tue.	Jan.	13
Fri.	Jan.	9	Sun.	Jan.	25
Fri.	Jan.	28	Fri.	Feb.	6
Wed.	Feb.	4	Wed.	Feb.	18
Fri.	Feb.	13	Mon.	Mar.	1
Fri.	Feb.	27	Sat.	Mar.	13
Thur.	Mar.	11	Thurs.	Mar.	25

2nd Quarter

Shipping Date			Sample Date		
Weekday	Month	Date	Weekday	Month	Date
Tue.	Mar.	23	Tue.	Apr.	6
Fri.	Apr.	2	Sun.	Apr.	18
Fri.	Apr.	16	Fri.	Apr.	30
Wed.	Apr.	28	Wed.	May	12
Mon.	May	10	Mon.	May	24
Fri.	May	21	Sat.	June	5
Thur.	June	3	Thurs.	June	17
Tue.	June	15	Tues.	June	29

3rd Quarter

Shipping Date			Sample Date		
Weekday	Month	Date	Weekday	Month	Date
Fri.	June	25	Sun.	July	11
Fri.	July	9	Fri.	July	23
Wed.	July	21	Wed.	Aug.	4
Mon.	Aug.	2	Mon.	Aug.	16
Fri.	Aug.	13	Sat.	Aug.	28
Thurs.	Aug.	26	Thurs.	Sept.	9
Tue.	Sept.	7	Tue.	Sept.	21

4th Quarter

Shipping Date			Sample Date		
Weekday	Month	Date	Weekday	Month	Date
Fri.	Sept.	17	Sun.	Oct.	3
Fri.	Oct.	1	Fri.	Oct.	15
Wed.	Oct.	13	Wed.	Oct.	27
Fri.	Oct.	22	Mon.	Nov.	8
Fri.	Nov.	5	Sat.	Nov.	20
Thurs.	Nov.	18	Thurs.	Dec.	2
Tue.	Nov.	30	Tue.	Dec.	14
Fri.	Dec.	10	Sun.	Dec.	26

Table 3
NASN Sampling Schedule

A **Sample Period** is defined as the period of time beginning four days before the date scheduled and ending seven days after the date scheduled. It is desired that every effort be made to collect a sample on the date scheduled. However, if a scheduled sample is missed, every effort should be made to collect a sample on the same day of the following week, but an otherwise valid sample will not be voided due to sampling on the wrong date.

1975

1ST QUARTER

Weekday	Month	Date	Sample Period
Mon.	Jan.	6	A
Sat.	Jan.	18	B
Thurs.	Jan.	30	C
Tues.	Feb.	11	D
Sun.	Feb.	23	F
Fri.	Mar.	7	F
Wed.	Mar.	19	G
Mon.	Mar.	31	H

2ND QUARTER

Sat.	Apr.	12	I
Thurs.	Apr.	24	J
Tues.	May	6	K
Sun.	May	18	L
Fri.	May	30	M
Wed.	June	11	N
Mon.	June	23	O

3RD QUARTER

Weekday	Month	Date	Sample Period
Sat.	July	5	P
Thurs.	July	17	Q
Tues.	July	29	R
Sun.	Aug.	10	S
Fri.	Aug.	22	T
Wed.	Sept.	3	U
Mon.	Sept.	15	V
Sat.	Sept.	27	W

4TH QUARTER

Thurs.	Oct.	9	X
Tues.	Oct.	21	Y
Sun.	Nov.	2	Z
Fri.	Nov.	14	AA
Wed.	Nov.	26	BB
Mon.	Dec.	~~8~~	CC
Sat.	Dec.	20	DD

1976

1ST QUARTER

Thur.	Jan.	1	A
Tue.	Jan.	13	B
Sun.	Jan.	25	C
Fri.	Feb.	6	D
Wed.	Feb.	18	E
Mon.	Mar.	1	F
Sat.	Mar.	13	G
Thurs.	Mar.	25	H

2ND QUARTER

Tue.	Apr.	6	I
Sun.	Apr.	18	J
Fri.	Apr.	30	K
Wed.	May	12	L
Mon.	May	24	M
Sat.	June	5	N
Thurs.	June	17	O
Tues.	June	29	P

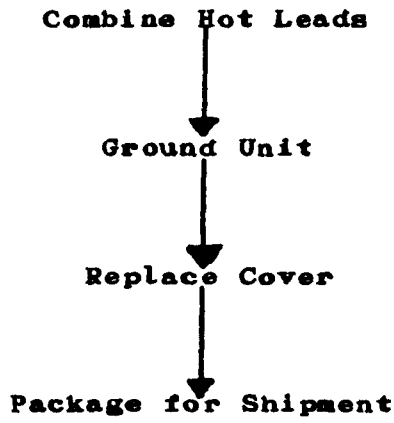
3RD QUARTER

Sun.	July	11	Q
Fri.	July	23	R
Wed.	Aug.	4	S
Mon.	Aug.	16	T
Sat.	Aug.	28	U
Thurs.	Sept.	9	V
Tue.	Sept.	21	W

4TH QUARTER

Sun.	Oct.	3	X
Fri.	Oct	15	Y
Wed.	Oct.	27	Z
Mon.	Nov.	8	AA
Sat.	Nov.	20	BB
Thurs.	Dec.	2	CC
Tue.	Dec.	14	DD
Sun.	Dec.	26	EE

TIMER WIRING



Timer Wiring

Most Dayton timers come with three cords. The male plug is on the main power cord. The other cords are for power to the samplers to be controlled. Power to one cord is normally ON while the other is normally OFF. For NASN use, this arrangement must be modified. CAUTION! All wiring changes must be done with the timer unplugged.

Step #1: Remove the lead from point 3B and connect it at point 3A with the other black lead. See Figure 2.

Step #2: Ground the green leads to the case with a bolt and nut.

Step #3: Replace the wiring cover.

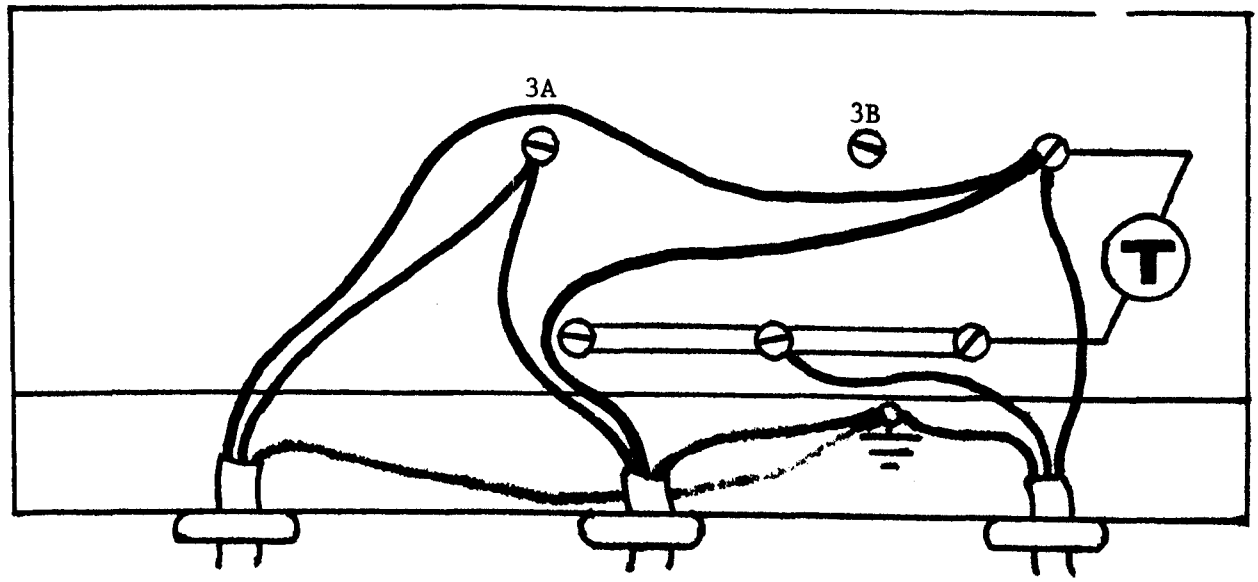
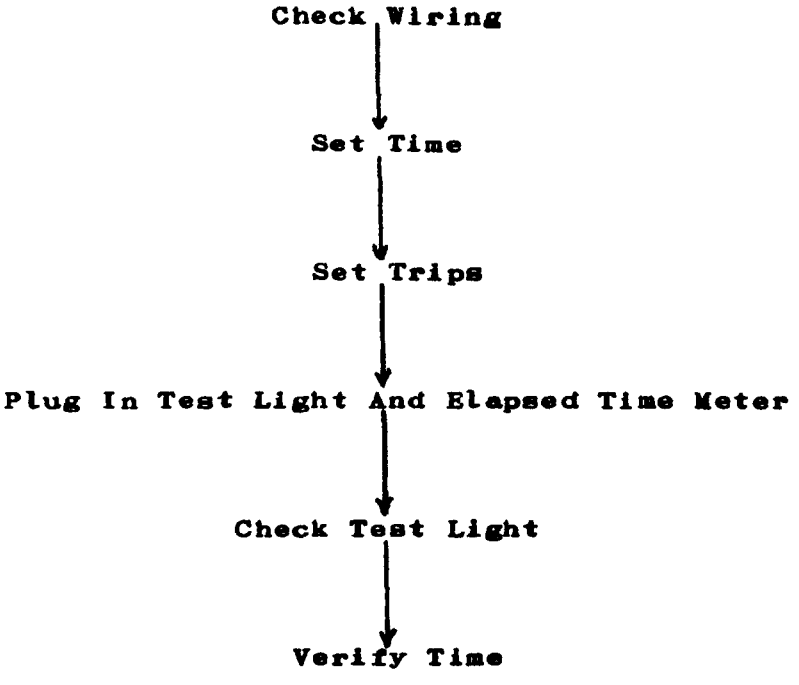


Figure 2
Timer Wiring Diagram

TIMER CALIBRATION



Timer Calibration

This procedure is performed before each timer is shipped into the field and again after it is returned from the field. Timers are calibrated at least annually. Calibration data are recorded in the Timer Calibration Log. See Figure 4.

Step #1: Plug a correctly wired timer into an electrical outlet on the test bench.

Step #2: Set the timer to the correct time.

Step #3: Set the ON and OFF time trippers for a 24-hour test period.

Step #4: Plug the test light into one of the output plugs and an elapsed time meter into the other.

Step #5: Check the system by manually operating the switch ON and OFF.

Step #6: Allow the system to operate for the 24-hour test period and determine the elapsed time from the elapsed time meter.

- If the elapsed time is 24 hours, ±15 minutes, the timer is acceptable for field use.
- If the elapsed time is not 24 hours ±15 minutes, reject the timer for field use.

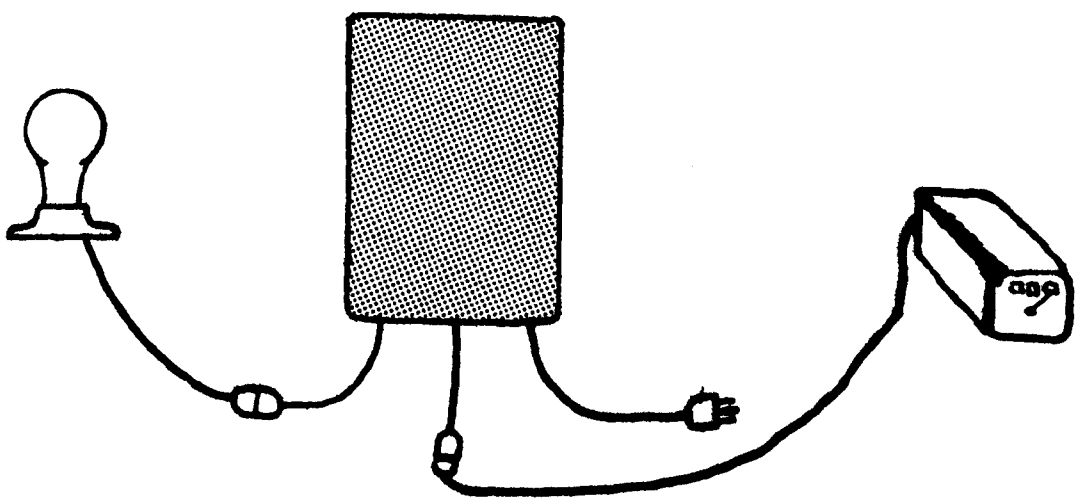


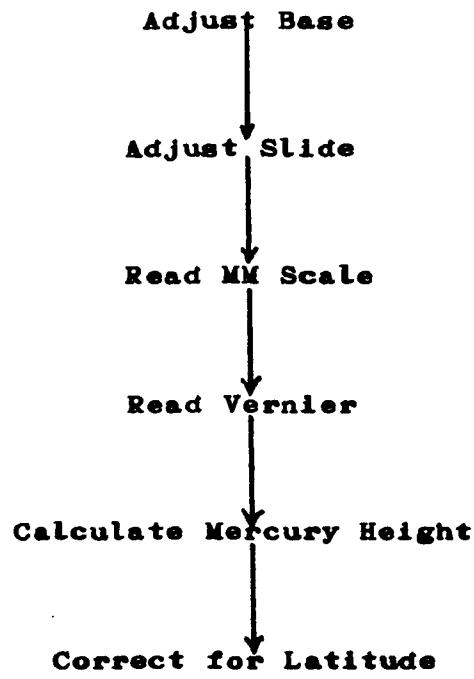
Figure 3
Timer Calibration System

Timer # 4-05-033

Date Start	Date Stop	Elapsed Time Indicator Serial No.	Test Period	Elapsed Time Indicator Reading	% Accuracy	By (Signature)
6/10/75	6/11/75	CW080 G	24 hours	23 hours 53 minutes	99.5	Jerry W. Burgan

Figure 4
Timer Calibration Log

Barometric Pressure Measurement



Barometric Pressure Measurement

This section outlines the procedure for measuring the barometric pressure with a U. S. Signal Corps type mercurial barometer.

Step #1: Adjust the base level of the mercury by turning the brass calibration screw at the base of the barometer until the white plastic point just touches the mercury pool surface. This is most easily done by watching the reflection of the point in the surface and bringing the two points together.

Step #2: Adjust the slide to the top of the mercury by rotating the knob on the right hand side of the tube. The bottom of the slide should be level with the very top of the mercury. See Figure 5.

Step #3: Read the right hand scale at the bottom of the slide to the nearest whole millimeter (mm). For example, Figure 5 has a reading of 710 mm.

Step #4: Read the vernier scale at the one place where the best matching of lines with the millimeter scale exists. For example, in Figure 5, this is at the 6 on the vernier scale and is read as 0.6 mm.

Step #5: Calculate the mercury column height by adding the values obtained in Steps 3 and 4 above.

For example:
710. mm from mm scale
0.6 mm from vernier
710.6 mm mercury column height

Step #6: Calculate the absolute barometric pressure by subtracting 0.8 mm from the mercury column height calculated in Step #5 above.

For example:

710.6 mm mercury column height
0.8 mm correction factor for earth's spin at $33^{\circ}57'$ latitude
709.8 mm mercury (Hg) barometric pressure

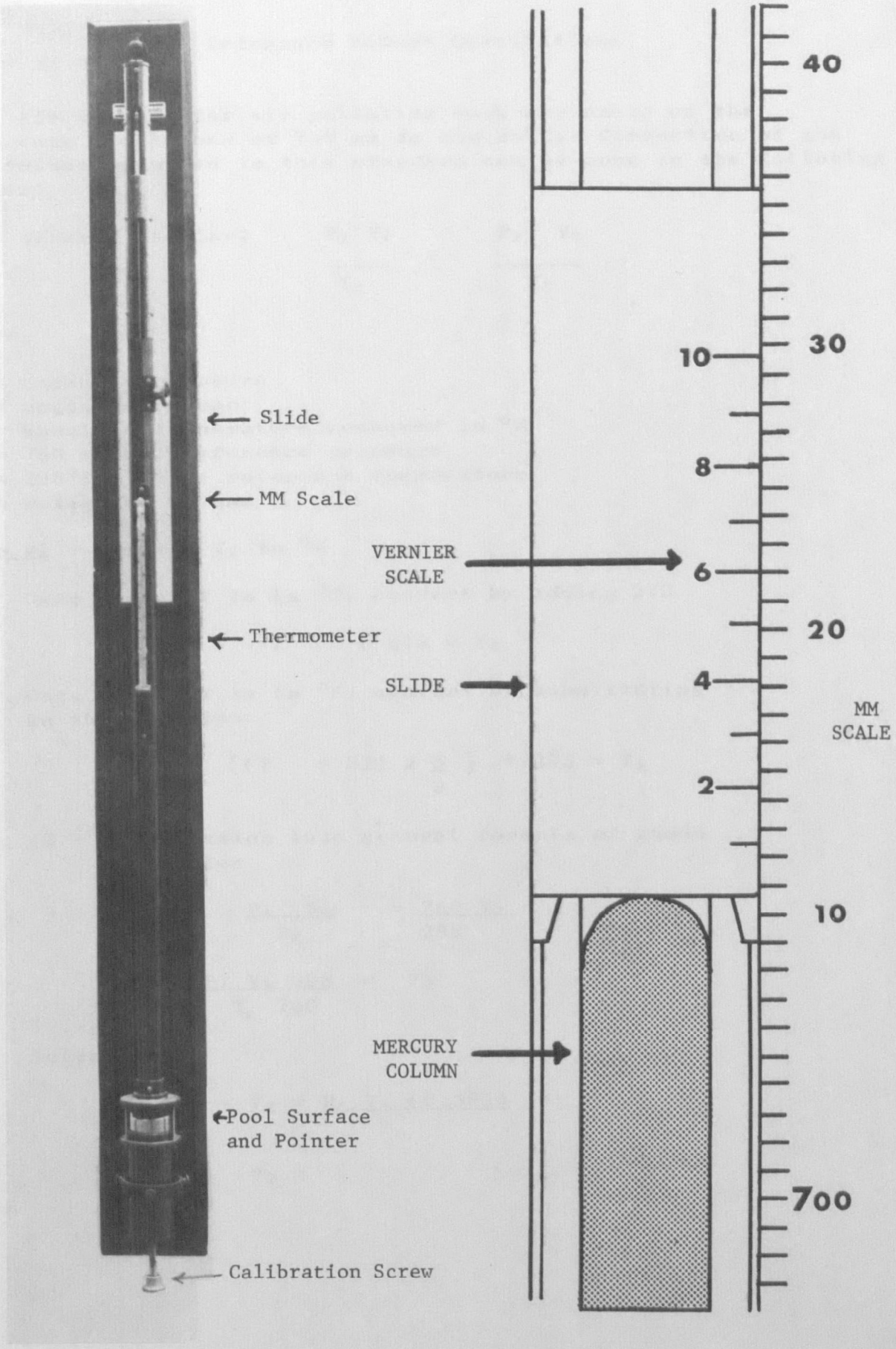


Figure 5
Barometer Detail

Reference Volume Calculations

Air volumes for air pollution work are based on the reference conditions of 760 mm Hg and 25°C. Correction of any air volume measured to this standard can be done in the following manner:

General Gas Law: $$\frac{P_1 V_1}{T_K} = \frac{P_2 V_2}{T_2}$$

where

P_1 = measured pressure
V_1 = measured volume
T_K = absolute temperature measured in °K
P_2 = 760 mm Hg; reference pressure
T_2 = 298°K = 25°C; reference temperature
V_2 = reference volume

Step #1 - Convert T_1 to °K

Case A - If T is in °C, convert by adding 273

$$T + 273 = T_K$$

Case B = If T is in °F, convert by substituting in the equation:

$$[(T - 32) \times \frac{5}{9}] + 273 = T_K$$

Step #2 - Substitution into general formula of known quantities

$$\frac{P_1 V_1}{T_K} = \frac{760 V_2}{298}$$

$$\frac{P_1 V_1 298}{T_K 760} = V_2$$

Solve for V_2

$$V_2 = \frac{P_1 V_1 (0.392)}{T_K}$$

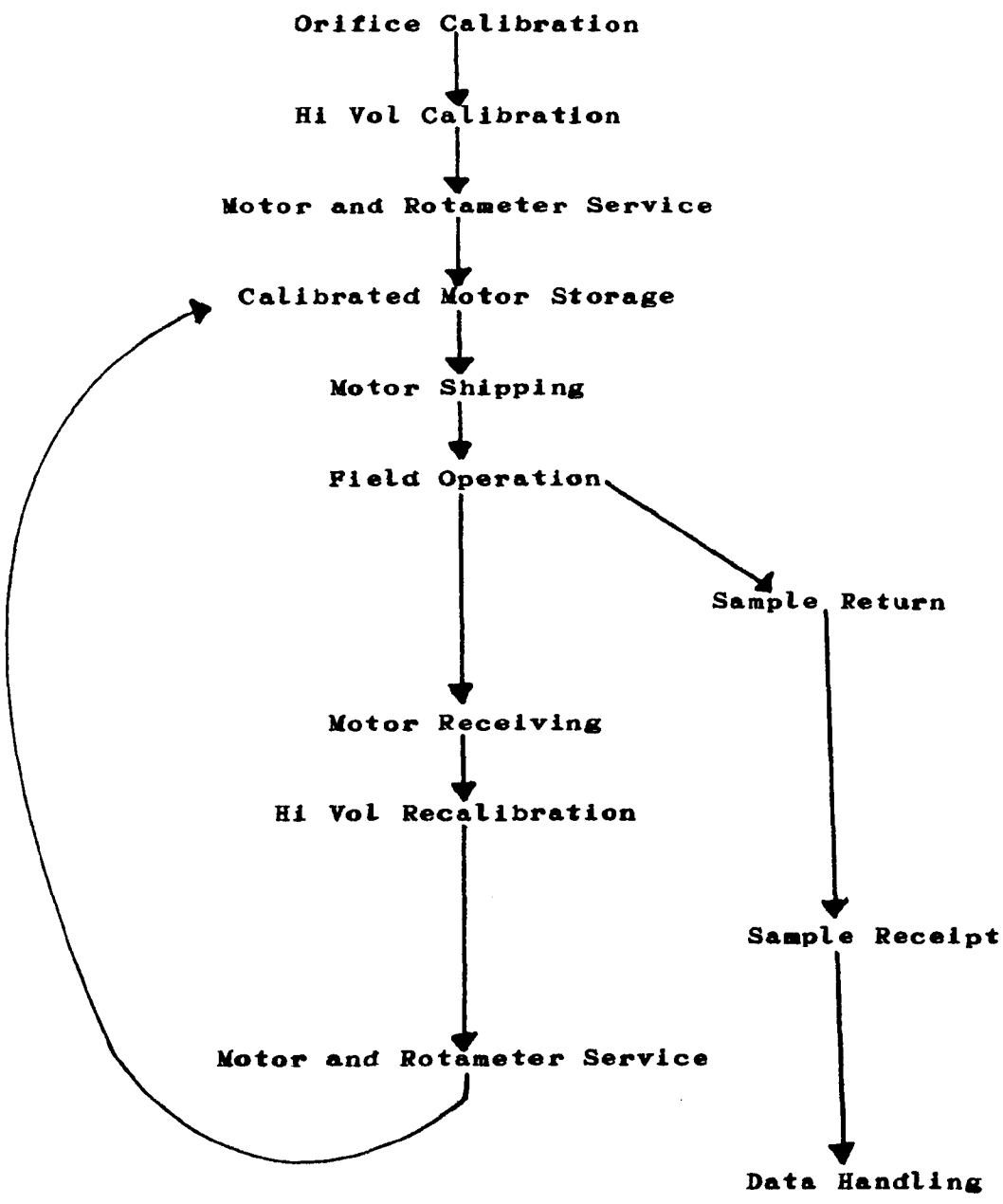
V_2 =

Section II
Hi Vol

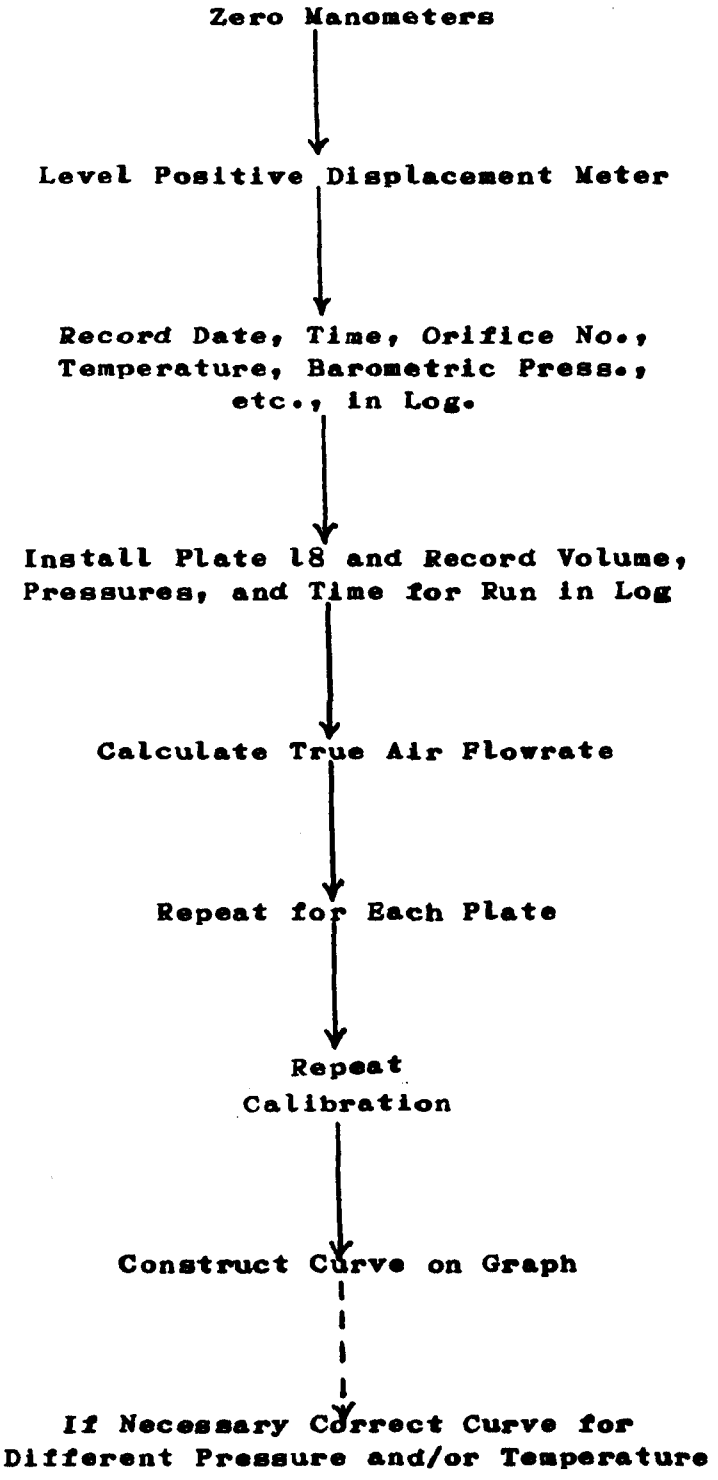
Section II
Hi Vol

This section contains specific information on the stepwise operation, calibration, maintenance, data handling and record keeping for hi vols. A generalized flow diagram outlining Section II is given. Each task is preceeded by a specific flow diagram and then a stepwise procedure.

Hi Vol


Orifice Calibration
Hi Vol Calibration
Motor and Rotameter Service
Calibrated Motor Storage
Motor Shipping
Field Operation
Sample Return
Motor Receiving
Hi Vol Recalibration
Sample Receipt
Motor and Rotameter Service
Data Handling

Hi Vol Orifice Calibration



Hi Vol Orifice Calibration

The hi vol orifice is calibrated semi-annually, or upon return from the field and whenever damage is suspected.

Step #1: Assemble the parts as shown in Figure 6 with the variac switch in the OFF position.

Step #2: Zero the water and mercury manometers by sliding their scales until the zero on the scale is level with the meniscus as illustrated in Figure 7.

Step #3: Check the level of the positive displacement meter table. Adjust the legs if necessary.

Step #4: Install Load Plate 18 between the orifice and the positive displacement meter.

Step #5: Turn the variac dial to zero, and switch the variac to the ON position.

Step #6: Turn the variac dial clockwise until the voltmeter reads 130 volts and let the system operate for 5 minutes. While the unit equilibrates, continue with steps 7-10 below.

Step #7: Write Plate #18 under the Plate # Column in the Hi Vol Orifice Calibration Log. See Figure 8.

Step #8: Record the date, time, orifice number, name of primary standard (positive displacement meter) and the serial number of the primary standard in the appropriate spaces in the log.

Step #9: Record the temperature in ^{o}C.

Step #10: Record the barometric pressure in cm Hg.

Step #11: Divide the barometric pressure by 10 and record this value in the Pa column. This is cm Hg.

$$Pa = \frac{\text{Barometric Pressure}}{10}$$

Step #12: After the 5-minute equilibration period, read the mercury manometer and record this value in column Pm. The example given in Figure 7 shows a reading of 7 centimeters (cm).

Step #13: Read the water manometer and record this in column Pt. The example given in Figure 7 shows a reading of 3.0 inches.

Step #14: Wind the stopwatch and set it in the horizontal position with the dial facing up.

Step #15: Locate the uncompensated dial on the left end of the positive displacement meter. The location is shown in Figure 6. Note: this dial must be viewed from the end. One revolution of

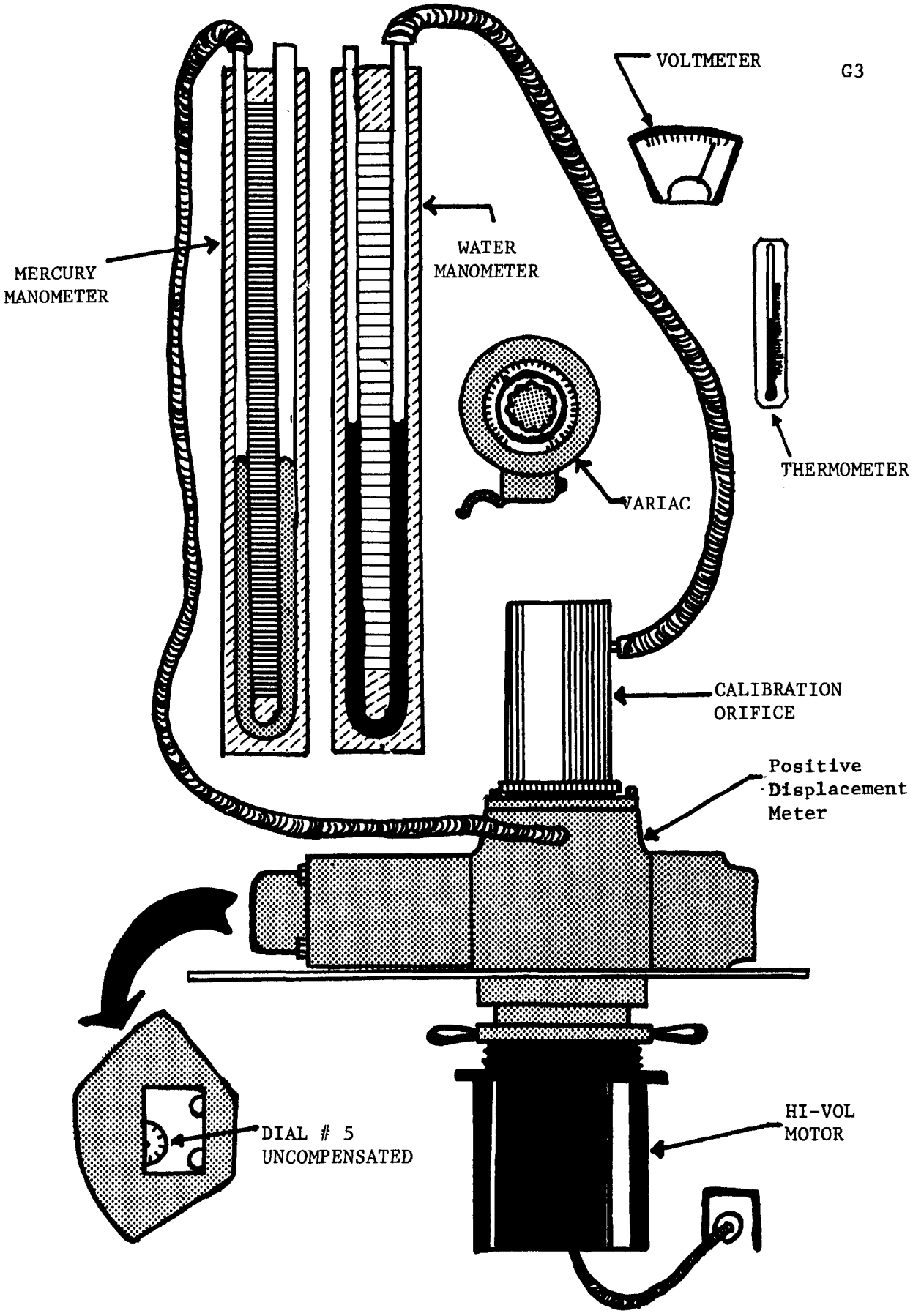


Figure 6
Positive Displacement Meter System

Dial #5 equals 10 cubic feet of air passed through the positive displacement meter.

Step #16: Use a stopwatch to measure the time in minutes and hundredths of minutes for exactly 10 revolutions of Dial #5 (or 100 cu. ft.) of air to pass through the positive displacement meter. Record 100 under column Vc and the elapsed time under column T.

Step #17: Record 2.83 under column Vm to convert cubic feet to cubic meters.

$$Vm = Vc \times 0.0283$$

$$100\ ft.^3 \times 0.0283\ \frac{M^3}{ft^3} = 2.83\ M^3$$

Step #18: Turn the motor Off by turning the dial of the variac counter-clockwise; then switch the variac to the OFF position.

Step #19: Repeat this procedure with each of the other load plates in the set.

Step #20: Repeat Steps 1-19 one time.

Step #21: Calculate and record Va for each run.

$$Va = Vm \left(\frac{Pa - Pm}{Pa}\right)$$

Step #22: Calculate and record Q for each run.

$$Q = \frac{Va}{T}$$

Step #23: Plot a graph of Q vs Pt to obtain the hi vol orifice calibration curve as illustrated in Figure 9. Use a french curve to draw a best fit smooth curve through the calibration points.

Step #24: If any calibration point does not fall within $\pm$1% of the curve, or causes the curve to be S-shaped or have a sharp turn, rerun that point, recalculate, and replot. The percent deviation can be calculated by taking the questionable flowrate (Q_o) and the calibration curve flowrate (Qc) for the same Pt reading.

$$\text{Percent deviation*} = \left(\frac{Qo - Qc}{Qc}\right) \times 100$$

*not to exceed $\pm$1%

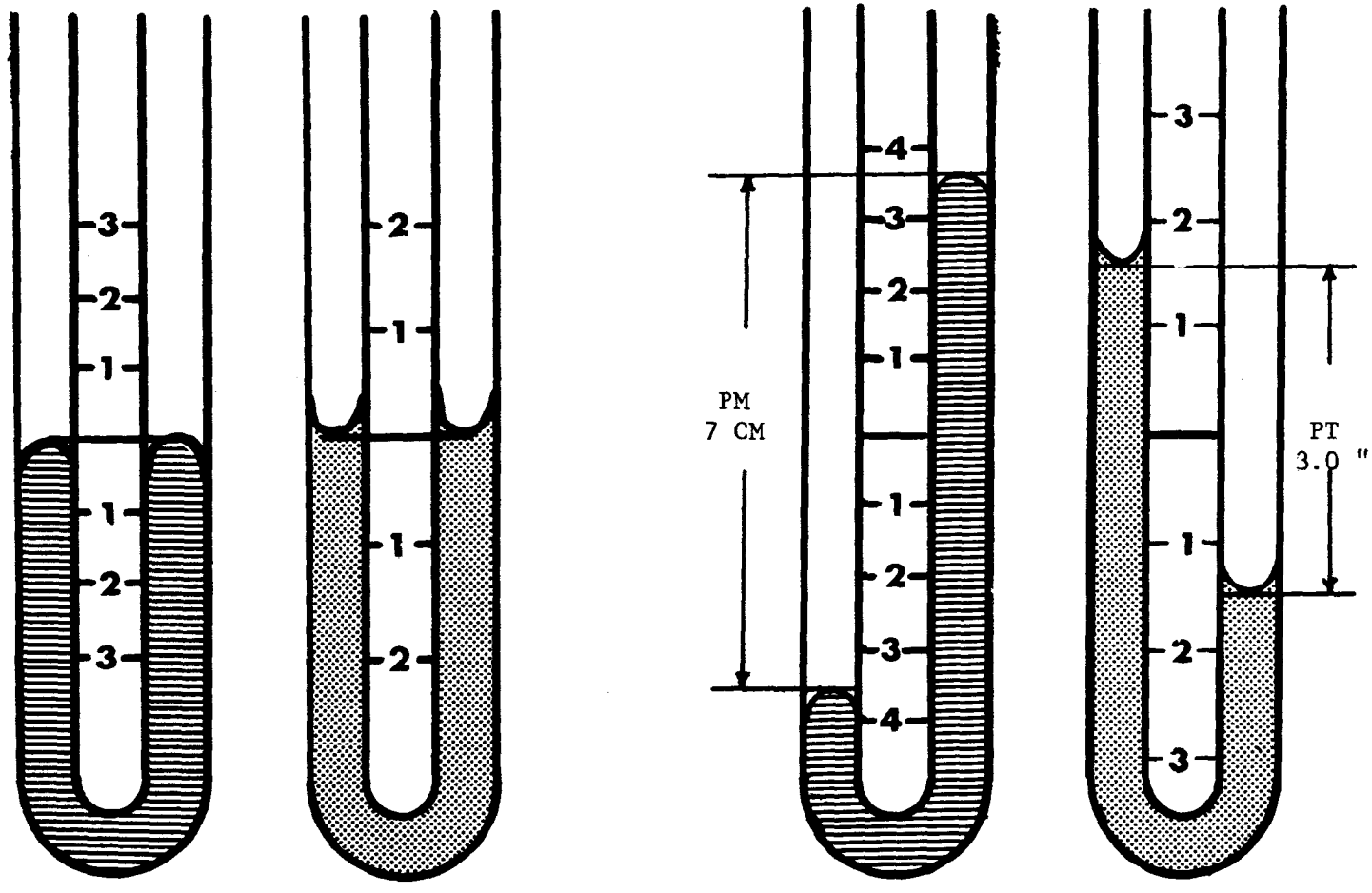


Figure 7
Manometers

Description / Derivation / Symbol / Plate Number	$Ft.^3$ of Air	M^3 of Air	Barometric Pressure	Vacuum in Standard in CM of Mercury	Absolute Volume M^3 $\frac{Pa-Pm}{Pa} Vm$	Time in Minutes	Flowrate $\frac{Va}{T}$	Pressure Drop Across the Orifice in inches of water
	Vc	Vm	Pa	Pm	Va	T	Q	Pt
	100	2.83						
	100	2.83						
	100	2.83						
	100	2.83						
	100	2.83						
	100	2.83						
	100	2.83						
	100	2.83						
	100	2.83						
	100	2.83						

Orifice Number _____ Manufacturer _____
Temperature _____ °C Barometric Pressure _____ Time _____ EST
Date _____ Primary Standard _____ Serial Number _____
Calibration voltage _____ Signed _____
Verified By _____

Figure 8
Hi Vol Orifice Calibration Log

Summary

Definitions

Va = Actual volume of air measured in cubic meters.

Vc = Volume measured by the positive displacement meter in cubic feet.

Vm = Volume measured by the positive displacement meter in cubic meters as calculated from Vc.

Pa = Atmospheric pressure in cm Hg.

Pm = Vacuum at the inlet of the positive displacement meter in cm Hg.

T = Minutes of time elapsed during run.

Q = Flowrate in cubic meters per minute.

Pt = Pressure drop across the orifice in inches of water.

Equations

$$Pa = \frac{\text{Barometric Pressure}}{10}$$

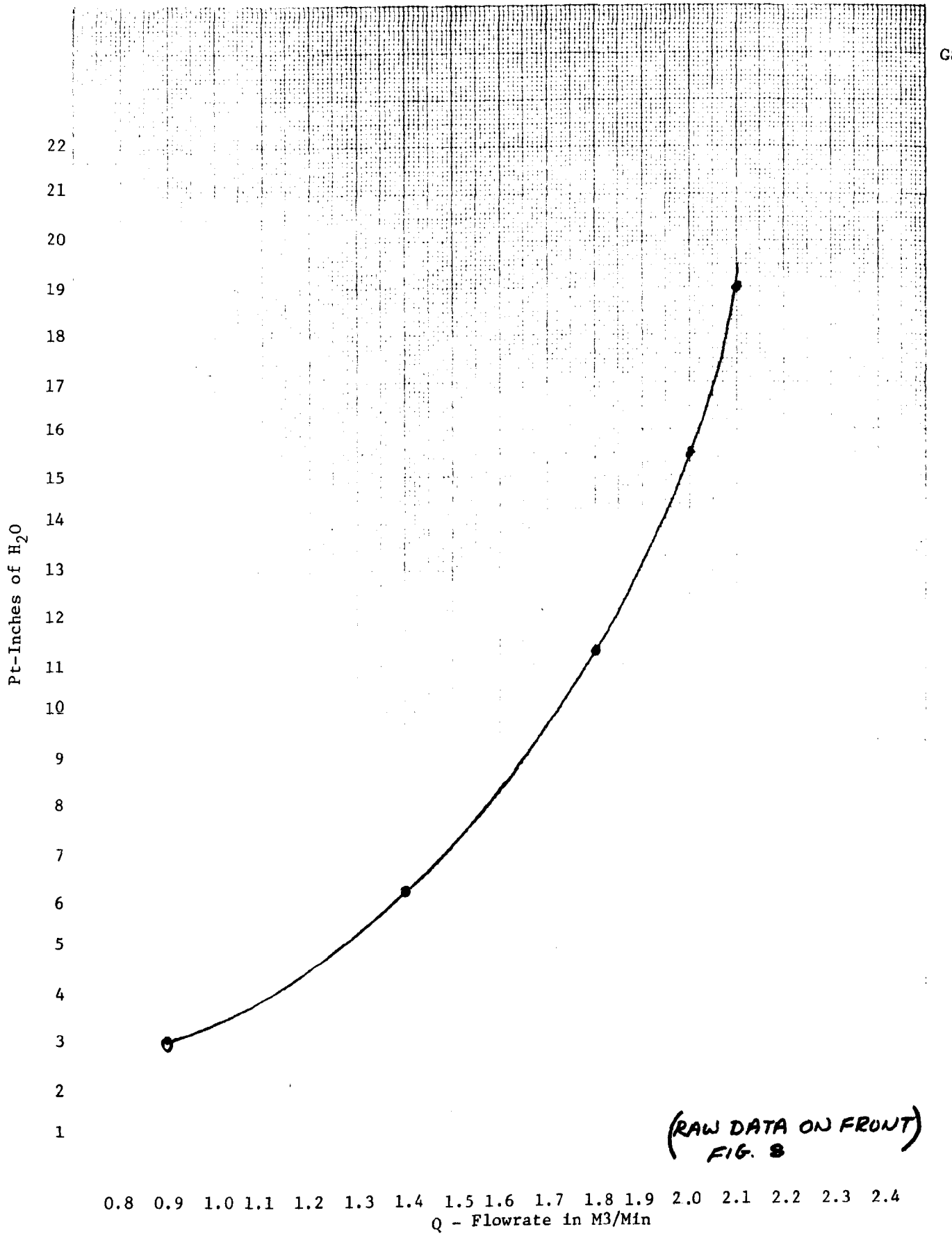
$$Vm = Vc \times 0.0283$$

$$Va = Vm \frac{(Pa-Pm)}{Pa}$$

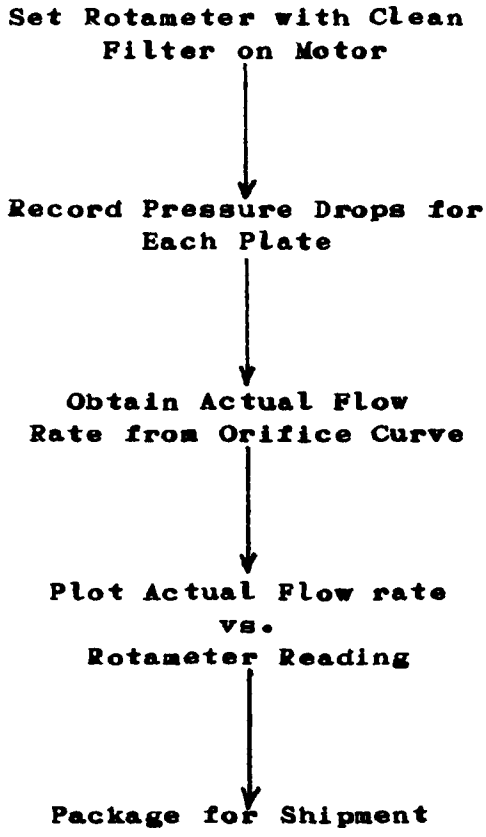
$$Q = \frac{Va}{T}$$

FIGURE 9 Hi-Vo Orifice Calibration Curve

G8



Hi Vol Calibration



Hi Vol Calibration

Hi Vol Calibration is performed at least three times each year on a routine schedule. Rotameter calibration is performed after routine preventive maintenance which includes repair or replacement of the hi vol motor, brushes, rotameter, rotameter hose or motor housing. The hi vol is calibrated when it is returned from the field prior to making any adjustments or performing any service. The rotameter must be used only with the hi vol motor and rotameter hose with which it was calibrated. The system must be calibrated and operated at the same voltage. All data during the initial and final calibrations for one hi vol are recorded on the same page in the Hi Vol Calibration Log. See Figure 10.

Step #1: Assemble a hi vol with a clean filter and operate it for at least 5 minutes at 115 volts. See Figure 11.

Step #2: Perform this step on units prior to shipment into the field. Omit this step on units being returned from the field. Assign the next consecutive number from the Hi Vol Calibration Log to this rotameter.

A. Record the rotameter number and date on three gummed labels.

B. Affix one gummed label to the very top of the metal part on the front of the rotameter.

C. Affix on gummed label to the middle of the vacuum hose.

D. Affix one gummed label to the side of the hi vol motor.

Step #3: Attach the rotameter to the hi vol motor as shown in Figure 12.

Step #4: Perform this step on units prior to shipment into the field. Omit this step on units being returned from the field. Adjust the rotameter so the center of the ball reads 60. See Figure 13.

A. Hold the rotameter vertically.

B. To adjust, loosen the locking nut by turning from left to right as seen from the front or counterclockwise as seen from above.

C. Turn adjusting screw clockwise to lower the ball or counterclockwise to raise the ball.

D. When the adjustment is made, tighten the locking nut making sure the ball continues to read 60.

E. Seal both the locking nut and the adjustment screw with hot melt glue. Do not cover the exhaust orifice.

F. Turn the hi vol motor OFF.

Rotameter Number _____
Motor Number _____
Site Name _____

Description / Derivation / Plate Number	Initial Rotameter Reading	Initial Pressure drop Across the Orifice inches of water	Initial M^3/minute Flowrate Q_1	Initial $Q_1 X \frac{T_2 P_1}{T_1 P_2}$ Corrected Q_2	Final Rotameter Reading	Final Pressure drop Across the Orifice in inches of water	Final M^3/minute Flowrate Q_1	Final $Q_1 X \frac{T_2 P_1}{T_1 P_2}$ Corrected Q_2

Date _____ Time _____ Temperature _____
Barometric Pressure _____ Orifice Number _____ Voltage _____

Signed _____ Verified By _____

Date _____ Time _____ Temperature _____
Barometric Pressure _____ Orifice No. _____ Voltage _____

Signed _____ Verified By _____

Figure 10
Hi Vol Calibration Log

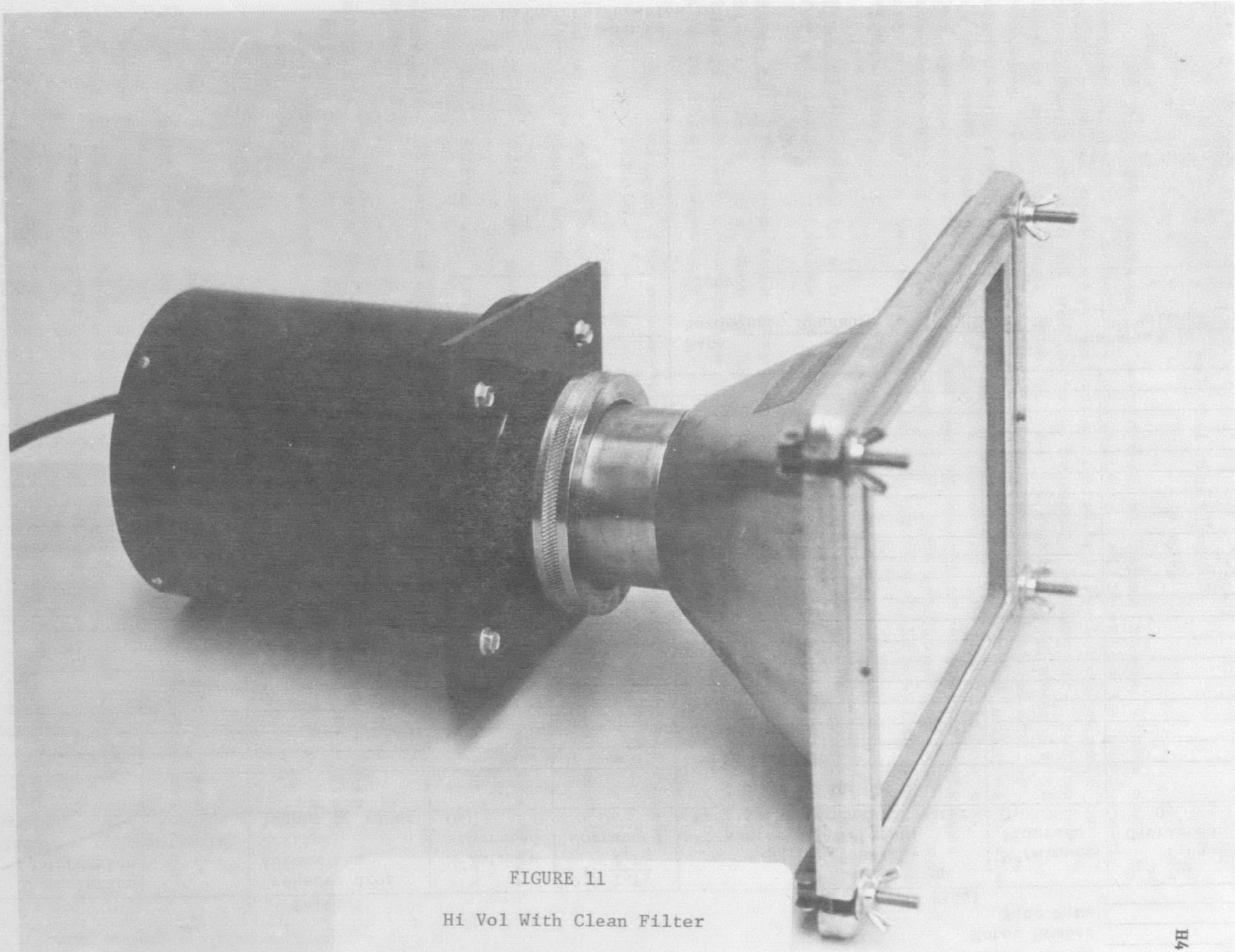


FIGURE 11

Hi Vol With Clean Filter

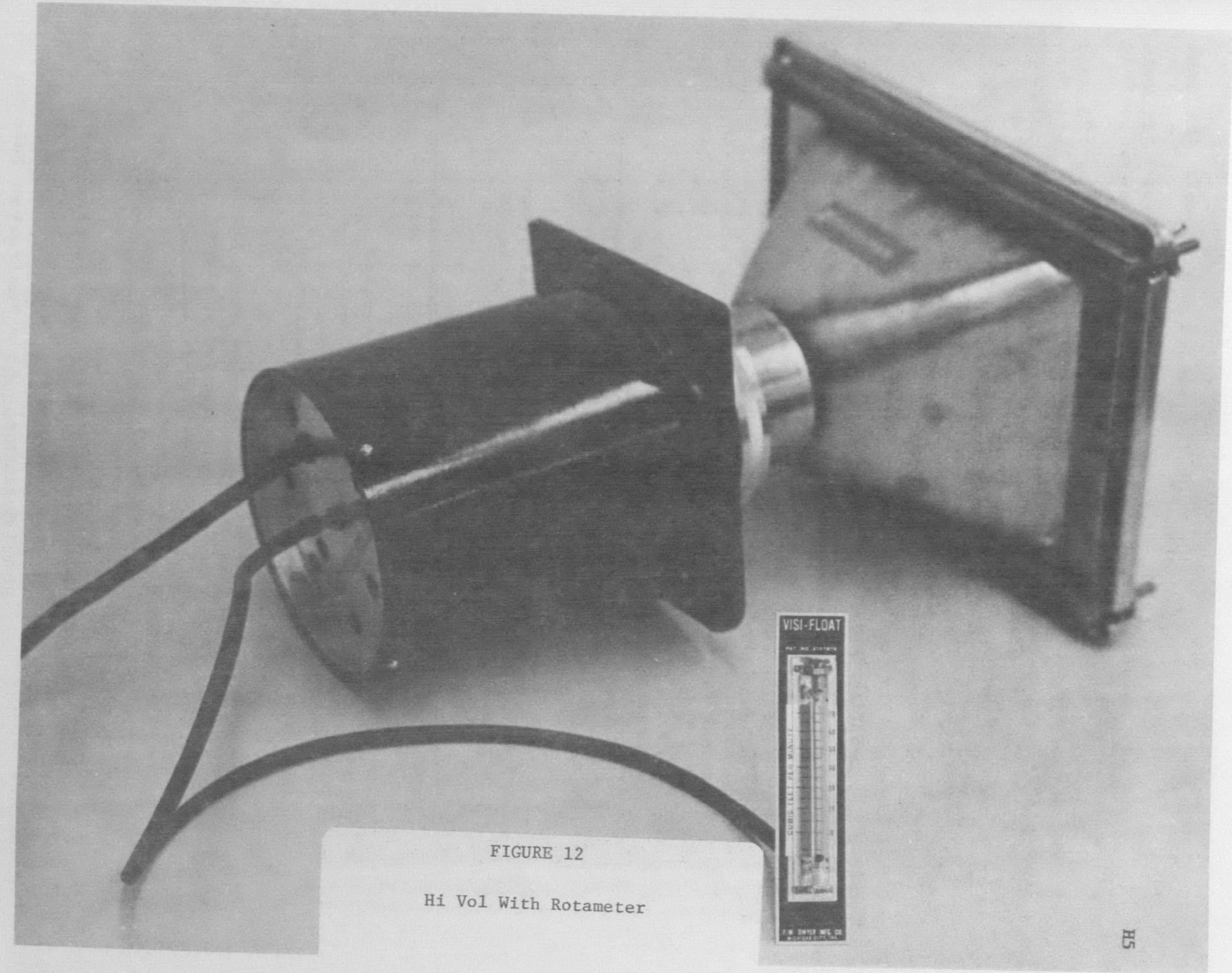


FIGURE 12

Hi Vol With Rotameter

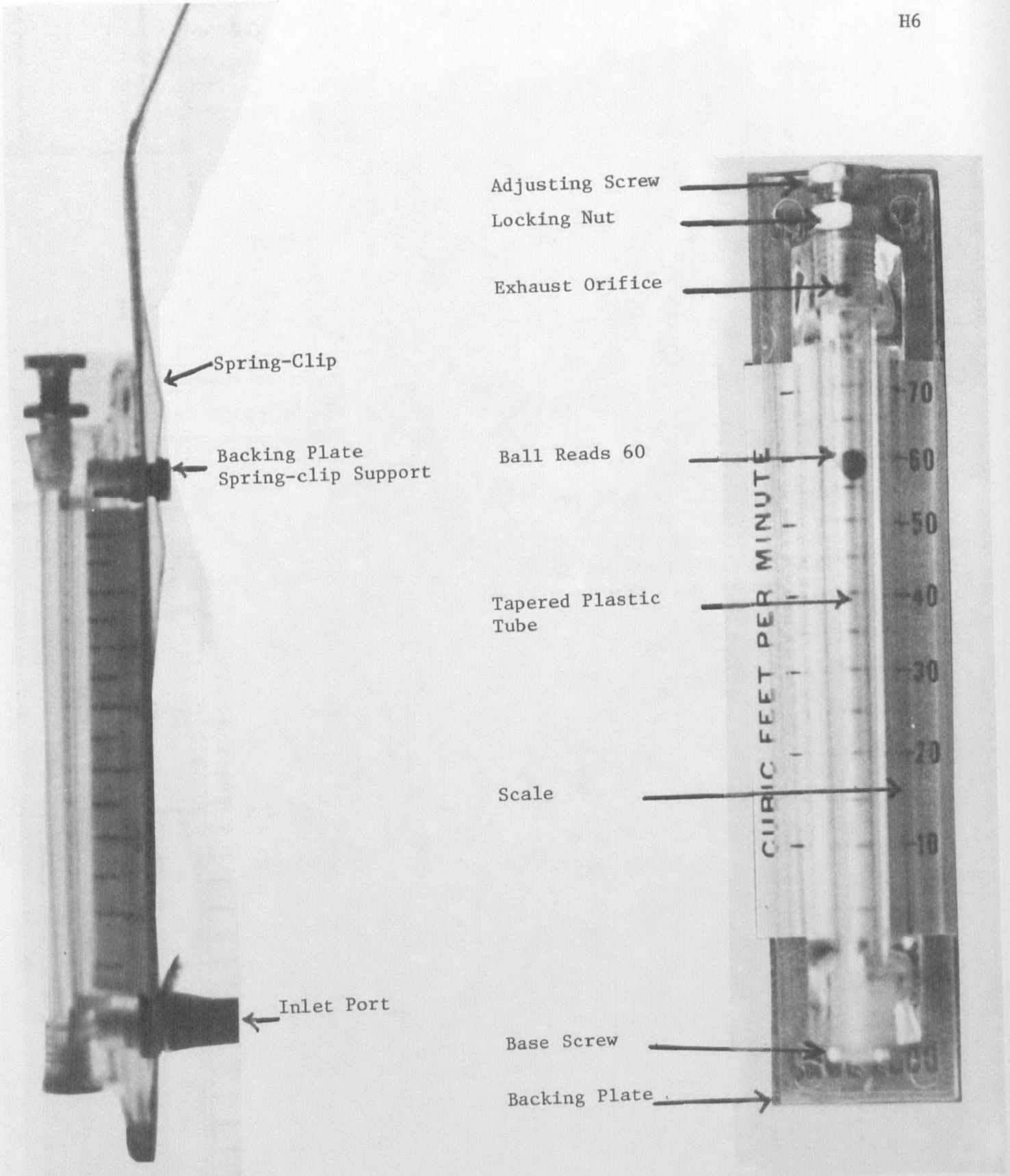


FIGURE 13

Hi-Vol Rotameter

Step #5: Remove the filter holder.

Step #6: Attach the calibrated orifice with one of the load plates between the motor and the orifice. See Figures 14 and 15.

Step #7: Turn the motor ON and record the water manometer and rotameter readings after they stabilize.

Step #8: Turn the motor OFF.

Step #9: Repeat Steps 6-8 above for each of the other load plates.

Step #10: Repeat Steps 6-9 once.

Step #11: Determine and record the air flowrate as read from the hi vol orifice calibration curve for each manometer reading.

Step #12: Record the barometric pressure and temperature in °C.

Step #13: Determine if the barometric pressure is within ± 10% of the barometric pressure measured when the hi vol orifice was calibrated.

- If the barometric pressure is within the ± 10% range, proceed to Step 14 below.
- If the barometric pressure exceeds the ± 10% range, proceed to Step 19 below.

Step #14: Determine if the temperature is within ± 50% (in °C) of the temperature measured when the hi vol orifice was calibrated.

- If the temperature is within the ± 50% range, proceed to Step 15 below.
- If the temperature exceeds the ± 50% range, proceed to Step 19 below.

Step #15: Plot the rotameter readings vs. the air flowrates as shown in Figure 16.

Step #16: Use a french curve to draw a best fit smooth curve through the calibration points.

Step #17: If any calibration point does not fall within ± 2% of the curve, or causes the curve to be S-shaped or have a sharp turn, rerun that point, recalculate, and replot. The percent deviation can be calculated by taking the questionable flowrate (Qo) and the calibration curve flowrate (Qc) for the same rotameter reading.

$$\text{percent deviation}^* = \left(\frac{Qo-Qc}{Qc}\right) \times 100$$

*not to exceed ± 2%.

FIGURE 14

Hi-Vol and Orifice Relative Positions

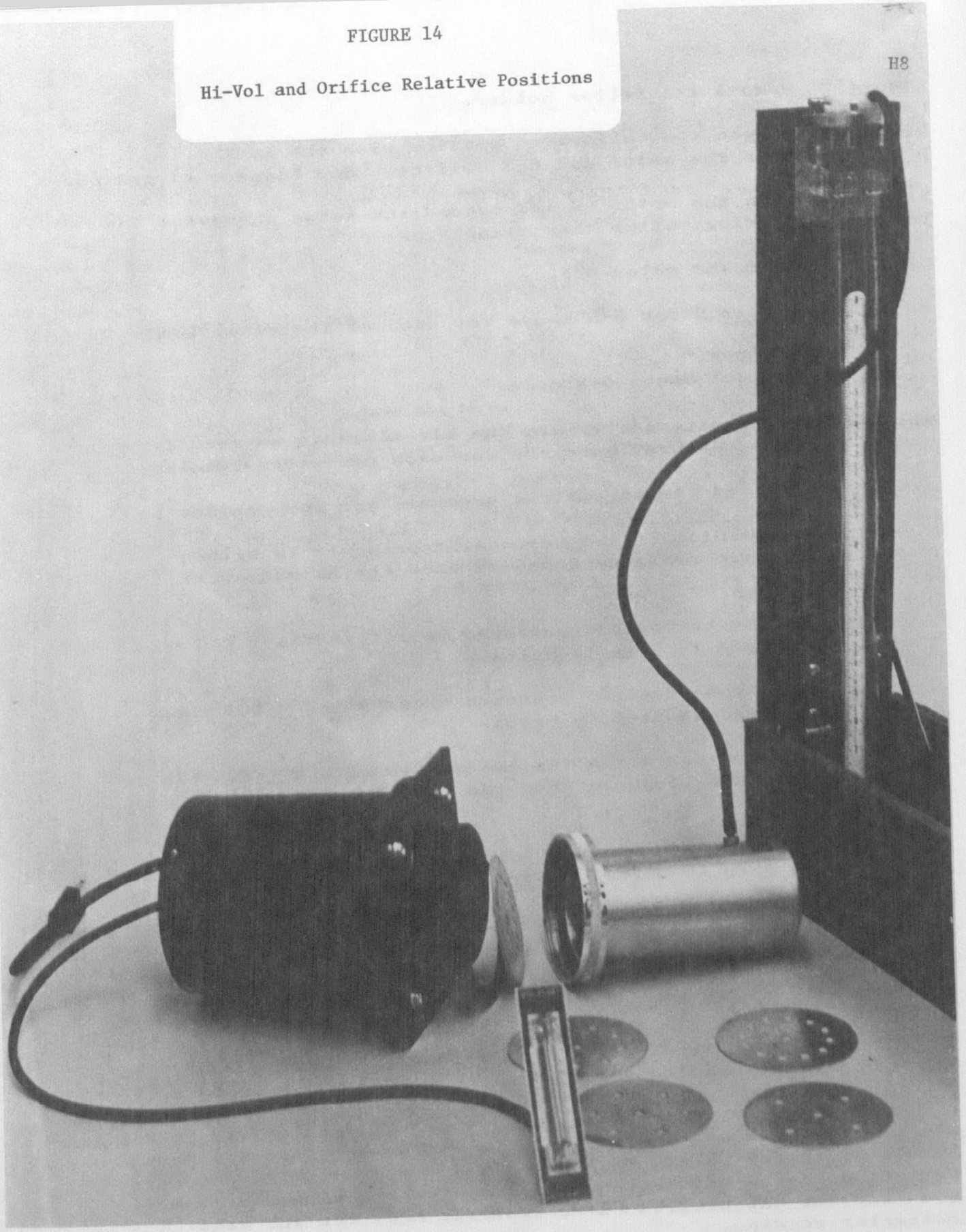
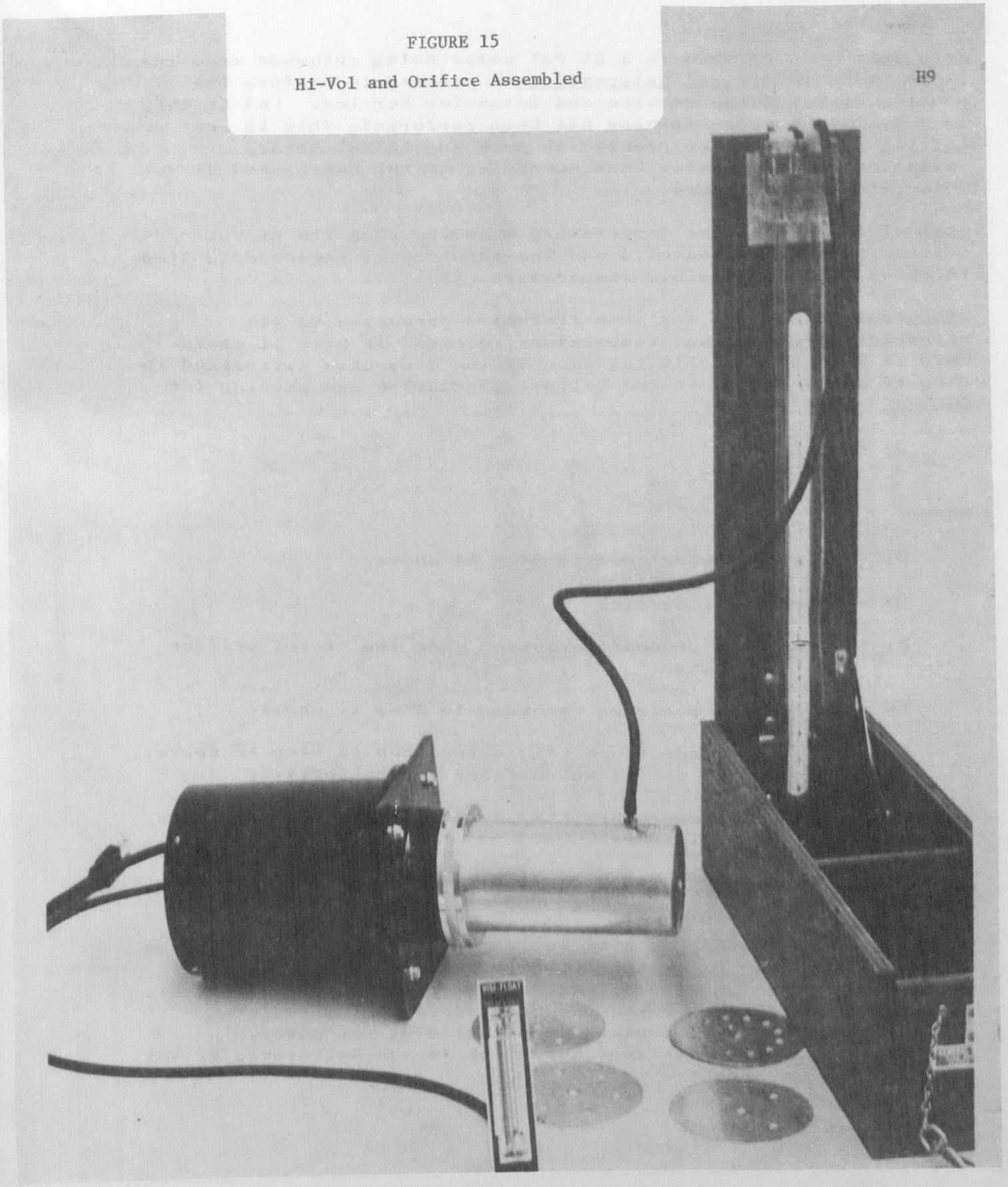


FIGURE 15

Hi-Vol and Orifice Assembled



Step #18: (a) If this is a hi vol motor being returned from the field, this is a final calibration so proceed to perform the routine Hi Vol Motor Service and Rotameter Service. (b) If this is a system on which service has been performed, this is an initial calibration so proceed to pack the hi vol motor, rotameter, and rotameter hose according to the Calibrated Hi Vol Motor Storage procedure.

Step #19: Convert the temperature measured when the hi vol orifice was calibrated (T_1) and the temperature recorded in Step 11 above (T_2) to absolute temperature (^oK).

Step #20: Determine the true flowrates corrected to the barometric pressure and temperature recorded in Step 11 above. This is done by substituting each of the flowrates determined in Step 14 above for Q_1 in the following equation and solving for Q_2.

$$Q_2 = Q_1 \sqrt{\frac{T_2 P_1}{T_1 P_2}}$$

where:

Q_1 = Flowrate determined in Step 14 above.

Q_2 = Corrected flowrate.

P_1 = Barometric pressure measured when the hi vol orifice was calibrated.

P_2 = Barometric pressure recorded in Step 11 above.

T_1 = Absolute temperature (^oK) determined in Step 18 above at the time the hi vol orifice was calibrated.

T_2 = Absolute temperature (^oK) determined in Step 18 above from Step 11 above.

Step #21: Plot the rotameter readings vs. the corrected flowrates.

Step #22: (a) If this is a hi vol motor being returned from the field, this is a final calibration so proceed to perform the routine Hi Vol Motor Service and Rotameter Service. (b) If this is a system on which service has been performed, this is an initial calibration so proceed to pack the hi vol motor, rotameter, and rotameter hose according to the Calibrated Hi Vol Motor Storage procedure.

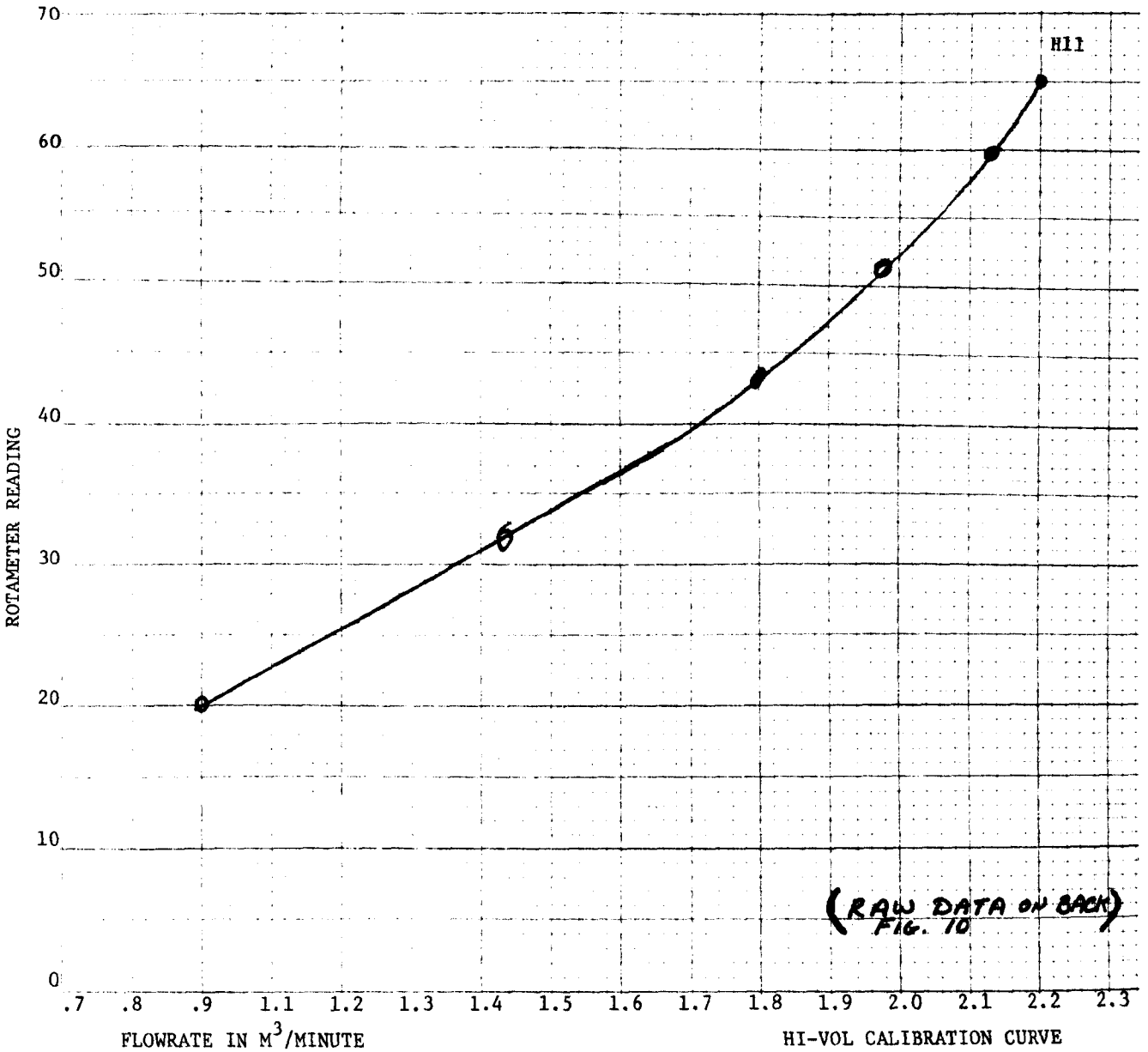

70
60
50
40
30
20
10
0
ROTAMETER READING
Hi1
(RAW DATA ON BACK)
FIG. 10
.7 .8 .9 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3
FLOWRATE IN M3/MINUTE
HI-VOL CALIBRATION CURVE

FIGURE 16

Calibrated Hi Vol Motor Storage

Immediately after service and calibration, the hi vol motor, rotameter and rotameter hose are packed for shipping.

Step #1: Assemble a cardboard box with approximate dimensions of 11" x 11" x 13" reinforcing the bottom well with heavy duty tape.

Step #2: Place a motor support insert in the box.

Step #3: Record the identification number of the calibrated hi vol motor on the outside of the box.

Step #4: Place the calibrated hi vol motor into the box so the faceplate of the motor rests on the four indentions of the motor support insert.

Step #5: Place the same rotameter and rotameter hose calibrated with that hi vol motor into a protective container.

Step 6: Record the identification number of the rotameter on the outside of the box below the hi vol motor identification number.

Step #7: Place the rotameter and rotameter hose into the box with its corresponding motor.

Step #8: Place a preaddressed return franked mailing label into the box with the motor.

Step #9: Place the top insert in the top of the box.

Step #10: Close and tape the top of the box with heavy duty tape so that box is ready for immediate shipping.

Step #11: Place the box in the calibrated hi vol storage area.

Hi Vol Motor Shipping

Hi vol motors are calibrated with an accompanying rotameter and rotameter hose and packed, ready for immediate shipment. Hi vol motors are scheduled to be replaced at least three times per year. See Table 4; Hi Vol Shipping Schedule.

Step #1: Remove the prepacked and precalibrated hi vol motor from the calibrated hi vol motor storage area.

Step #2: Examine the wrapping tape and box for tampering or visible signs of damage.

Step #3: Affix the NASN site mailing address to a franked mailing label.

Step #4: Affix the franked mailing label to the box being careful not to cover the identification numbers for the hi vol motor or rotameter.

Step #5: Place label tape over the mailing label.

Step #6: Transcribe the identification numbers from the box to the Site Action Log and the Property Log. See Figures 17 and 1.

Step #7: Affix a FRAGILE label over the identification numbers on the box, and place label tape over the FRAGILE label.

Step #8: Make a copy of the hi vol calibration curve and mail it to the site cooperator along with a form letter. See Figure 18.

Step #9: File a copy of the letter in the Site File and record that a letter contact was made in the Site Action Log.

Step #10: Mail the letter and the box.

STATE	SHIPPING DATE #1	SHIPPING DATE #2	SHIPPING DATE #3
Alabama	February - 1st Week	June - 1st Week	October - 1st Week
Florida	February - 2nd Week	June - 2nd Week	October - 2nd Week
Georgia	February - 3rd Week	June - 3rd Week	October - 3rd Week
Kentucky	February - 4th Week	June - 4th Week	October - 4th Week
Mississippi	March - 1st Week	July - 1st Week	November - 1st Week
North Carolina	March - 2nd Week	July - 2nd Week	November - 2nd Week
South Carolina	March - 3rd Week	July - 3rd Week	November - 3rd Week
Tennessee	March - 4th Week	July - 4th Week	November - 4th Week

TABLE 4

Hi Vol Shipping Schedule

	Action Taken	Date	Initials
	phone call to find out correct sample time for 1/6/75 samples; time was not checked on GSRS; I. R. Sampler reports sample was run 12 midnight to 12 midnight on 1/6/75, sample time 0000-2400 should have been marked	1/10/75	JWB
	Bubbler pump #4-03-999 shipped to site	2/8/75	JWB
	letter sent	2/8/75	JWB
	Bubbler pump #4-03-998 received; gage was broken, otherwise the condition was good	2/15/75	JWB
	Liquid meter #4-01-998, rainflat and hose #4-02-899 shipped to site	2/20/75	JWB
	letter sent	2/20/75	JWB

Podunk Holler, GA.
11 9999 001

Figure 17
Site Action Log

ENVIRONMENTAL PROTECTION AGENCY
REGION IV
SURVEILLANCE AND ANALYSIS DIVISION
ATHENS, GEORGIA 30601

17 June 1975

Mr. I. R. Sampler
Rt. #1
Nowhere Road
Podunk Holler, GA 12345

Dear Mr. Sampler;

Under separate cover we have mailed your new hi vol motor, visifloat, and hose. The old unit should be replaced before the next sampling date. Use the shipping container to return the old unit to us for refurbishment and recalibration. Use the pre-paid label supplied.

Enclosed is a copy of the calibration curve for the new unit. This curve is for your agency use if you desire to take samples for your own program on non-NASN sampling dates. Please make a note that when reporting flow to us on the Particulate Sample Record Sheet, do not use the curve but report the visifloat reading.

If you encounter difficulties with your sampler, please call at 404/546-2297.

Sincerely,

Jerry W. Burger

Jerry W. Burger
NASN Coordinator

Enclosure

FIGURE 18

Hi-Vol Form Letter

Hi Vol Motor Receipt and Service - New

This procedure is performed for each new hi vol motor received.

Step #1: Examine the hi vol motor for obvious damage.

Step #2: Plug the power cord into a 110 volt outlet and verify that it operates.

Step #3: Assign the next consecutive number from the Hi Vol Property Log.

Step #4: Engrave the assigned number above the manufacturer's identification plate on the side of the motor housing.

Step #5: Record the assigned number and the manufacturer's serial number as illustrated in Figure 1.

Step #6: Operate the motor for 18 hours in the burn-in rack. See Figure 19.

Step #7: Tag the hi vol motor as "conditioned - ready for calibration" and place the hi vol motor in the storage area for calibration.

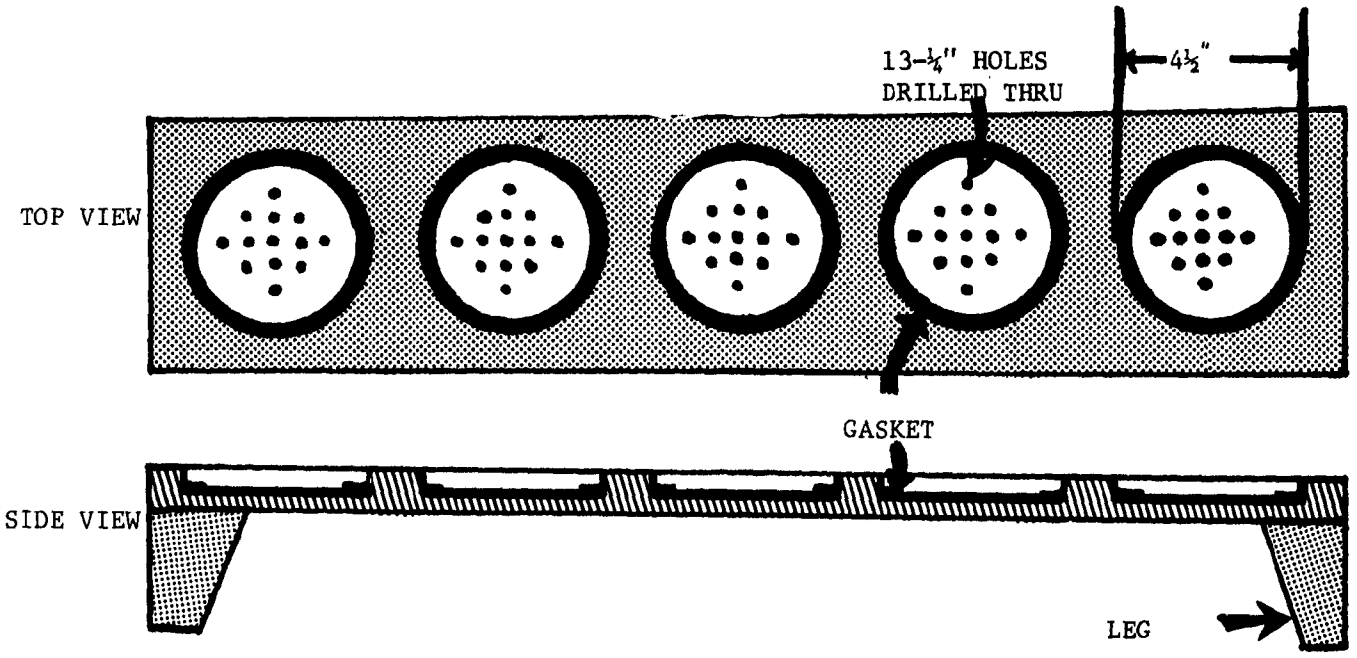


Figure 19
Hi Vol Burn-In Rack

Hi Vol Motor Receipt--Used

Hi vol motors are replaced on a routine schedule. The units being returned from the field are logged in and calibrated prior to any service being performed on the motor.

Step #1: Place the box in the storage area for hi vol motors being returned from the field.

Step #2: NOTE: This step should not be started unless there is ample time to perform this procedure and perform a final calibration before any service is performed.

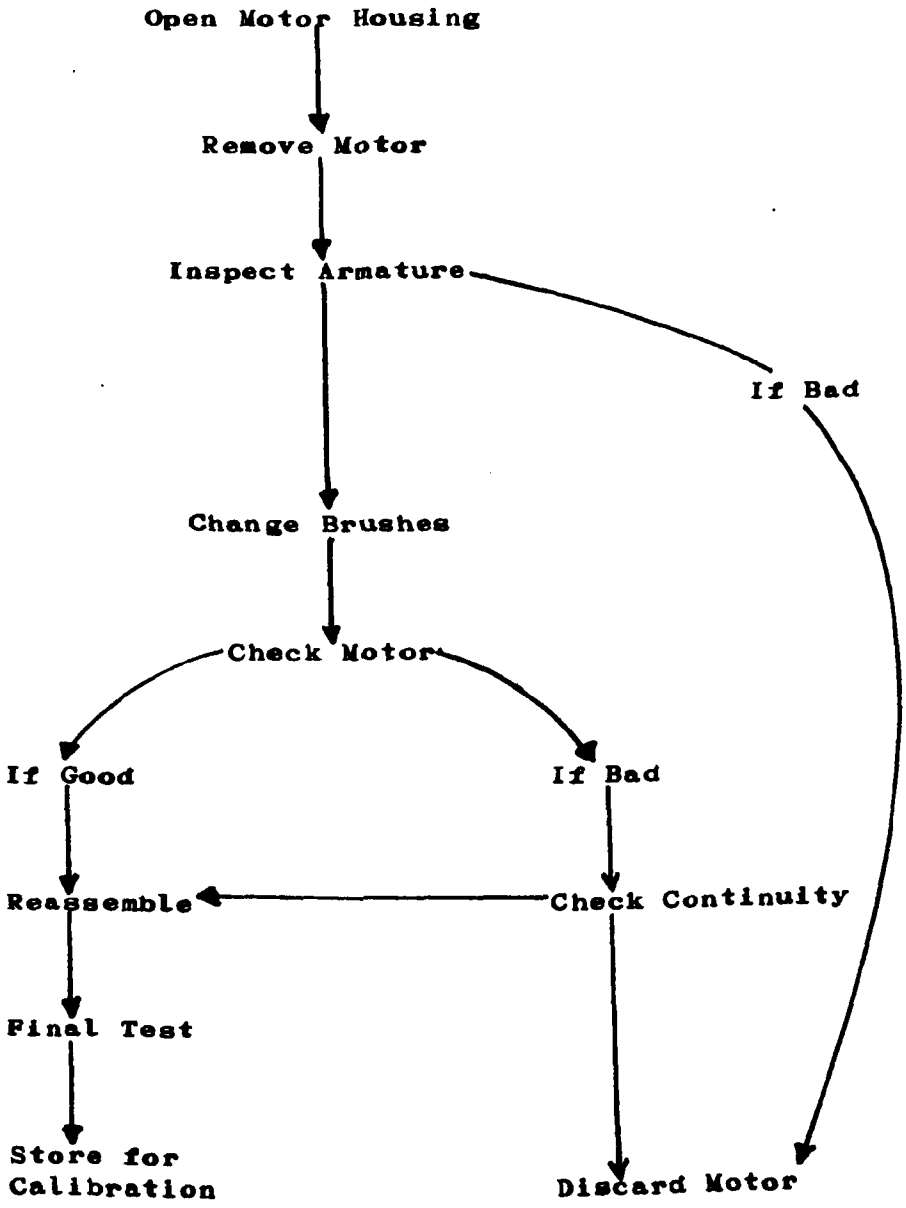
Remove the hi vol motor, rotameter and rotameter hose from the box.

Step #3: Document the return of the hi vol motor in the Hi Vol Property Log. See Figure 1.

Step #4: Document the return, and visible external condition of the hi vol motor, rotameter and rotameter hose in the Site Action Log. See Figure 17.

Step #5: Attach the rotameter hose to the hi vol motor, proceed to step 6 in the Rotameter Calibration section, and perform a final calibration. NOTE: Do not perform any service until this calibration is performed. Record these calibration data on the same page containing the initial calibration data.

Hi Vol Motor Service - Used



Step #1: Remove the 4 screws from the mounting plate as illustrated in Figure 20.

Step #2: Withdraw the motor from the housing as illustrated in Figure 21 and examine the power cord for cracked or damaged insulation.

Step #3: Replace the power cord if it shows any sign of cracking or insulation damage.

Step #4: Inspect the armature for wear. If it is defective, replace the entire motor.

Step #5: Remove the two screws, releasing one brush holder clip and brush assembly as illustrated in Figure 22.

Step #6: Lift the brush from the channel in the motor.

Step #7: Detach the electrical connector from the brush assembly. See Figure 23.

Step #8: Attach the elctrical connector to a new brush.

Step #9: Depress the carbon brush into the brush assembly and place it into the channel in the motor.

Step #10: Replace the brush holder clip and screws. Tighten the screws snugly. Attach the yellow ground wire to one of the brush holder screws.

Step #11: Repeat Steps 5 thru 10 for the other brush.

Step #12: Strap-down the motor and plug the power cord into a 110 volt outlet.

- If the motor starts, proceed to Step 13 below.
- If the motor does not start, unplug the motor and proceed to Step 19 below.

Step #13: Unplug the motor.

Step #14: Clean the inside and outside of the motor housing and motor with clean, dry air or a clean, dry cloth and remove the gummed label.

Step #15: Slide the motor back into the housing.

Step #16: Reassemble the housing and mounting plate with the 4 screws.

Step #17: Operate the motor for 18 hours in the burn-in rack. See Figure 19.

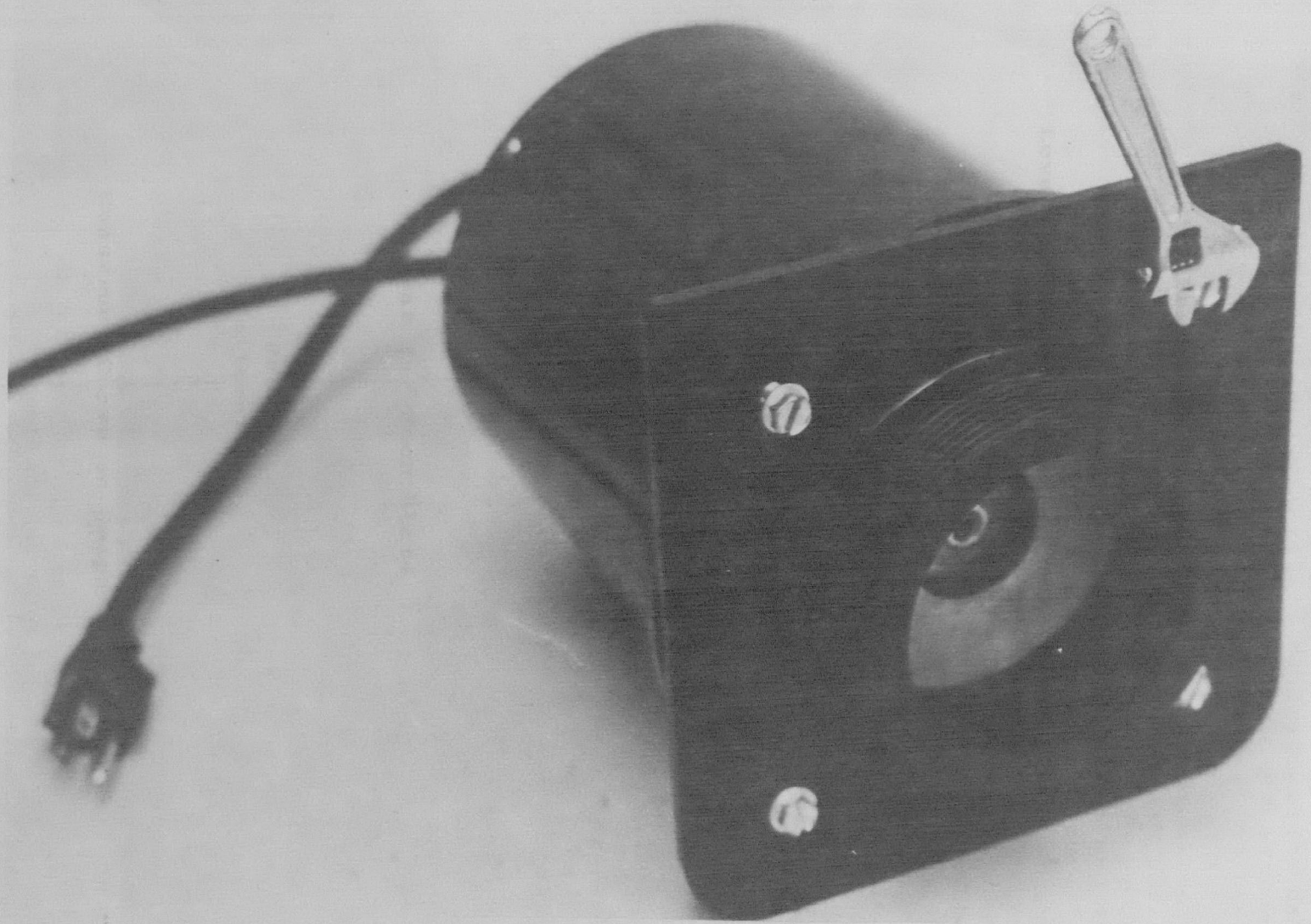


FIGURE 20

Hi Vol Motor Service Step #1

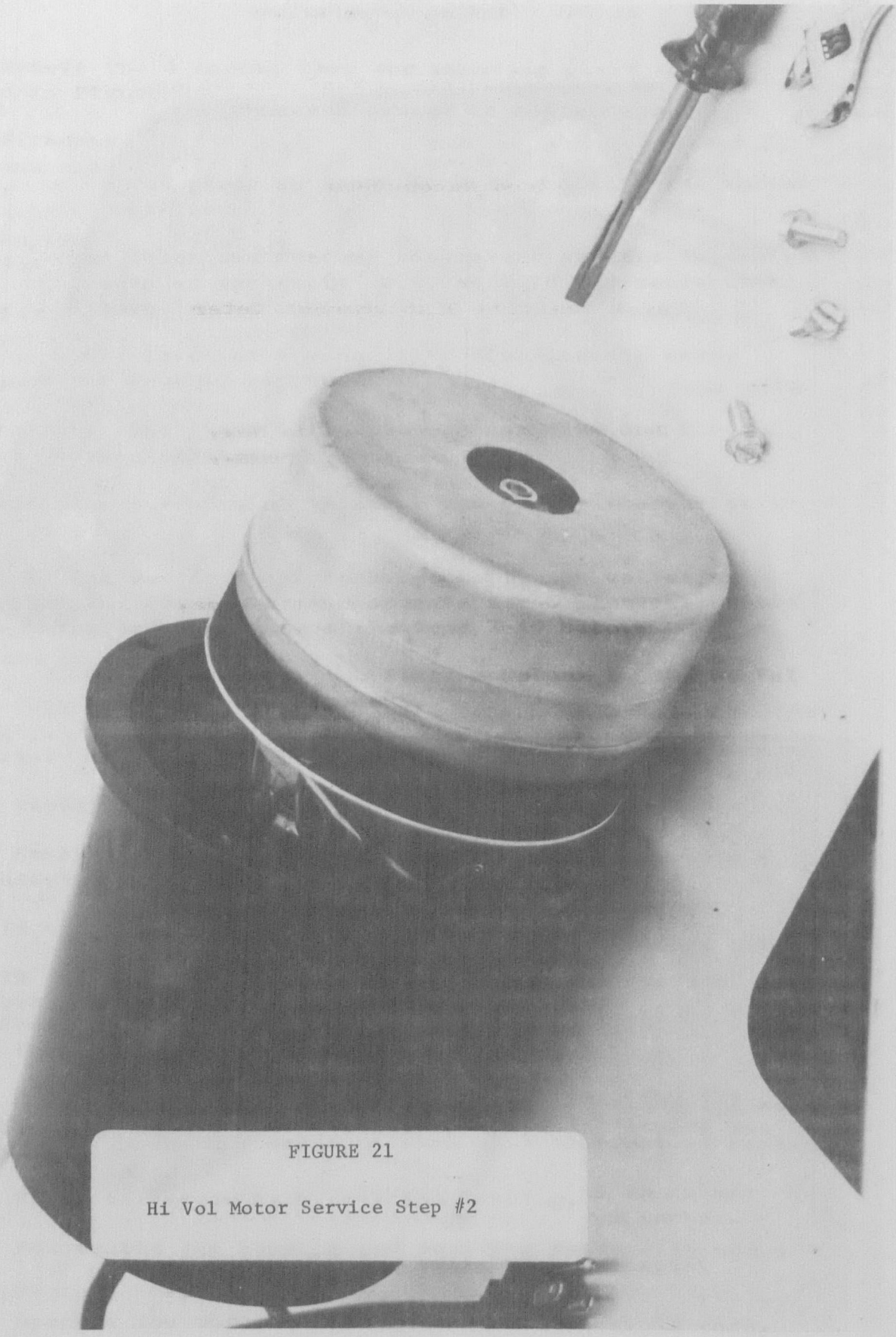


FIGURE 21

Hi Vol Motor Service Step #2

FIGURE 22

Hi Vol Motor Service Step #5

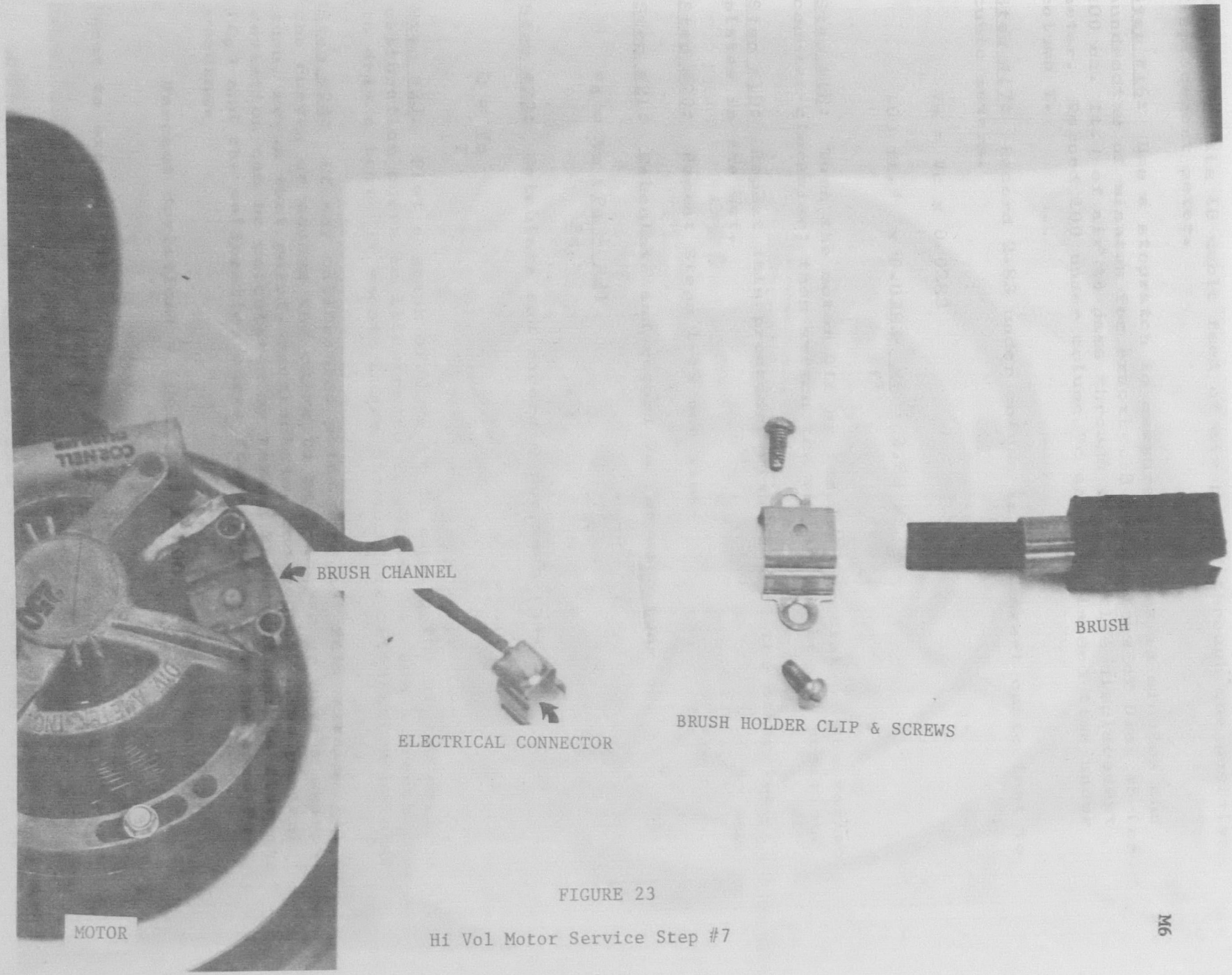


FIGURE 23

Hi Vol Motor Service Step #7

Step #18: Tag the hi vol motor as "conditioned - ready for calibration" and place the hi vol motor in the storage area for calibration.

Step #19: Check all electrical connections and insure that the clips are on the brushes. Tighten loose connections.

Step #20: CAUTION! This step is dangerous and must be performed with caution. Safety gloves must be worn. Check the incoming power cord for continuity with an AC voltmeter.

A. Set the voltmeter for an AC volt range above 120 V.

B. Unscrew the wire nuts from the wire bundle where the power cord connects to the motor.

C. Attach one voltmeter clip to one wire junction and one voltmeter lead to the other wire junction.

D. Plug the motor power cord into a 110 volt outlet.

E. The voltmeter should read 120±10.

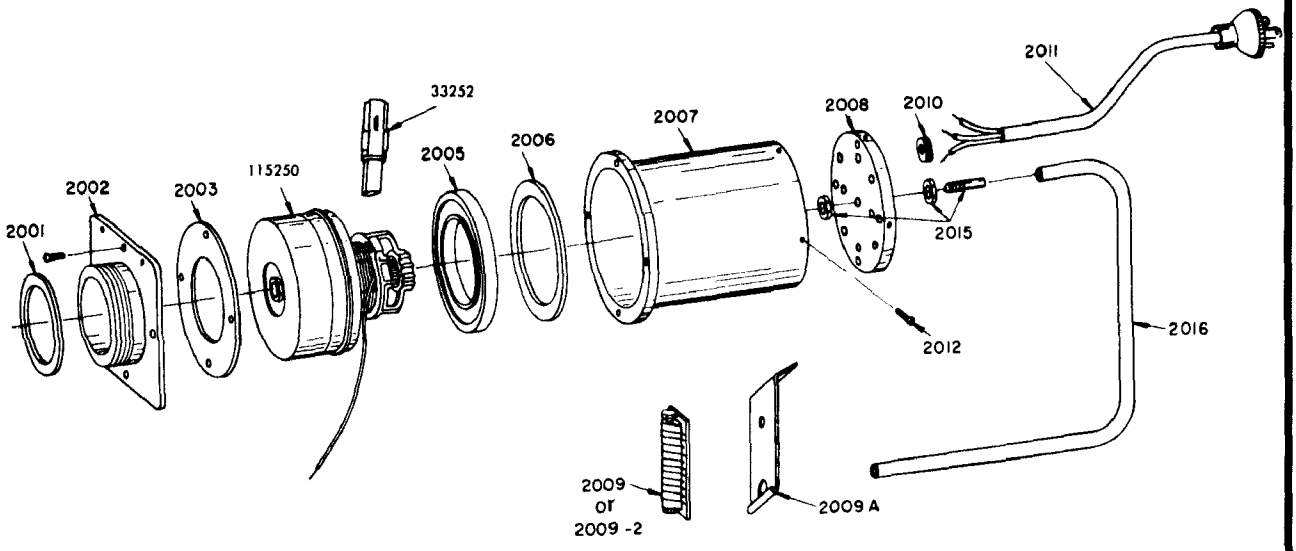
F. Unplug the hi vol motor.

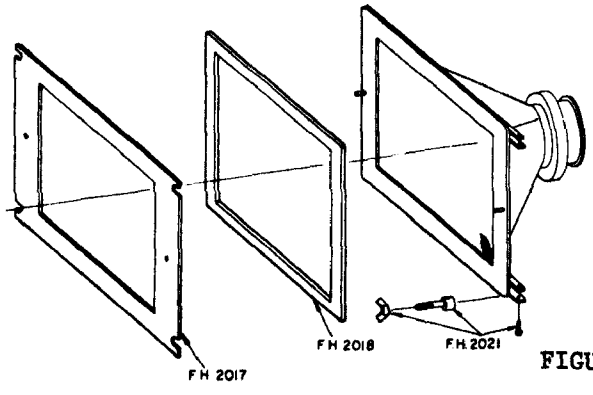
- If the motor starts, replace the wire nuts and reassemble the motor and proceed with Step 15.
- If the motor fails to start, salvage the power cord, brushes, brush clips and brush clip screws. Discard the motor. See Figure 24.

BLOWER/MOTOR REPLACEMENT PARTS

Part No.	Description
2000	Blower/Motor Assembly Complete less filter holder
2001	Neoprene Gasket
2002	Mounting Plate Motor Cover
2003	Neoprene Gasket
2005	Motor Cushion
115250	0.6 H.P. Motor with special U-clip connectors
33252	Motor Brushes
215276	Armature with Bearings
2006	Motor Mounting Ring

Part No.	Description
2007	Motor Housing
2008	Orifice Plate
2009	Flowmeter No. 440
2009-A	Flowmeter Mounting Plate
2009-2	Precision Bored Flowmeter
2010	Grommet
2011	Power Cord Assembly
2012	Assembly Bolts and Nuts
2015	Pressure Tap Assembly
2016	Tubing



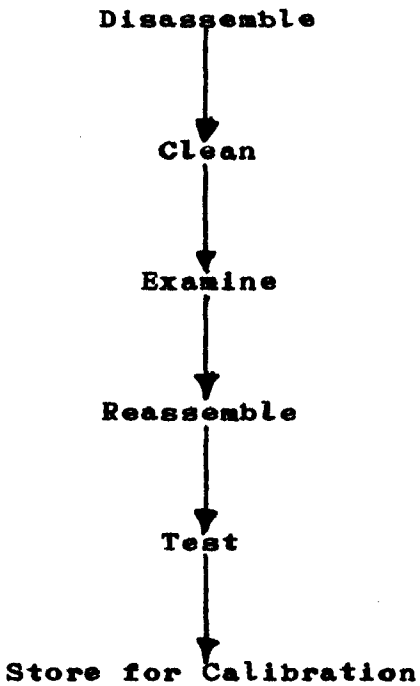


Part No.	Description
F.H.2100	Filter Holder Complete
F.H.2017	Aluminum Hold Down Frame
F.H.2018	Rubber Gasket 8"x10"
F.H.2021	Wing Nut & Bolt with Rivet

FIGURE 24

Hi-Vol Parts Breakdown

Rotameter Service



Rotameter Service

Rotameter service is performed at least three times per year on a routine schedule. The rotameter is serviced at the same time the hi vol motor is serviced.

Step #1: Remove and discard the rotameter hose and gummed label from the rotameter.

Step #2: Remove the spring-clip from the back of the rotameter. See Figure 13.

Step #3: Separate the backing plate, scale, and the tapered plastic tube.

Step #4: Grasp the hot melt glue with a pair of needle nose pliers and gently remove the glue being careful not to damage the rotameter with the pliers.

Step #5: Loosen the locking nut on top of the rotameter.

Step #6: Remove the adjusting screw and gently tilt the tube allowing the ball to pour into a beaker half full of water.

Step #7: Place the adjusting screw into a beaker half full of mineral spirits.

Step #8: Remove the base screw and place it in a beaker half full of mineral spirits.

Step #9: Unscrew the inlet port and the backing plate spring-clip support and place them into a beaker half full of mineral spirits.

Step #10: Examine the tapered plastic tube for cracks, breakage, stripped threads, deep discoloration, etching or other obvious signs of damage. Discard any tubes with one or more of these symptoms.

Step #11: Clean the tapered plastic tube with a pipe cleaner and mineral spirits, and dry.

Step #12: Remove the inlet port and the backing plate spring-clip support from the mineral spirits and examine for corrosion, damaged threads, or other obvious signs of damage.

Step #13: Clean the base screw with mineral spirits and examine for stripped threads or damage.

Step #14: Dry the base screw and wrap one layer of teflon tape around the threads.

Step #15: Screw the base screw snugly into the bottom of the tapered plastic tube.

Step #16: Clean the inlet port and the backing plate spring-clip support with a pipe cleaner and mineral spirits, and dry.

Step #17: Wrap one layer of teflon tape around the threads on the inlet port and the backing plate spring-clip support making sure no part of the teflon tape extends over the openings.

Step #18: Screw the inlet port into the lower part of the tapered plastic tube and the backing plate spring-clip support into the upper part of the tapered tube.

Step #19: Dry the rotameter ball with a clean soft tissue or soft cloth. NOTE: At no time handle the ball with hands or fingers.

Step #20: Place the ball into the tapered plastic tube.

Step #21: Clean the locking nut and adjusting screw with mineral spirits and examine for stripped threads or damage.

Step #22: Dry the locking nut and adjusting screw and wrap one layer of teflon tape around the threads of the adjusting screw making sure the teflon tape does not extend beyond the threads.

Step #23: Screw the adjusting screw into the top of the tapered plastic tube.

Step #24: Tilt the tapered plastic tube to make sure the ball falls freely without sticking. If the ball sticks, discard the tapered plastic tube and ball.

Step #25: Assemble the rotameter.

Step #26: Cut a 30" length of 3/16" ID by 5/16" OD neoprene tubing to be used as a rotameter hose.

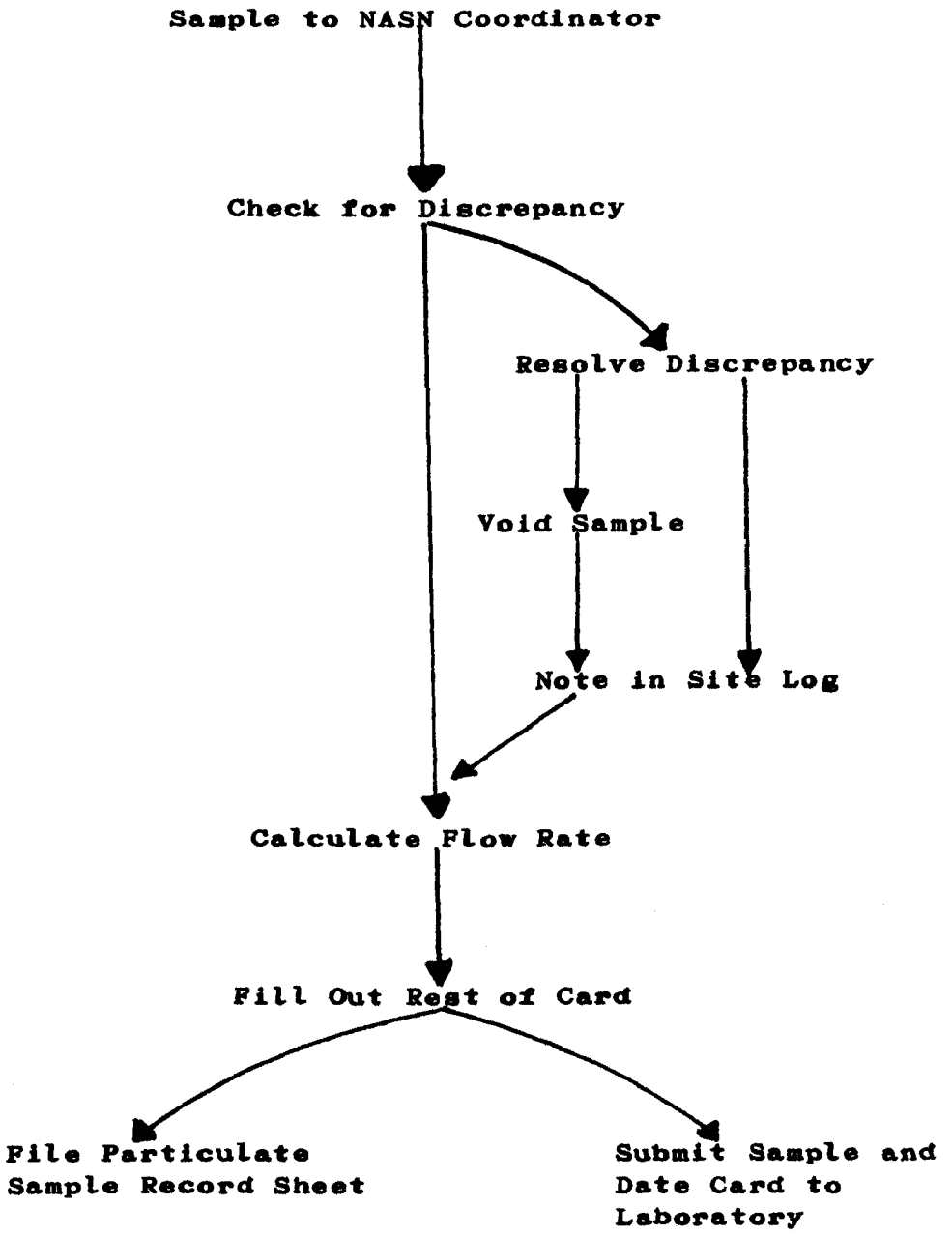
Step #27: Attach the rotameter hose to the inlet port of the rotameter.

Step #28: Secure the rotameter hose to the inlet port by twisting 20-gage steel wire around the hose.

Step #29: Flush clean dry air through the rotameter to dry the rotameter.

Step #30: Place the rotameter and rotameter hose in the clean rotameter storage area.

Particulate Data Handling



The Particulate Record Sheet is used by the person who operates the hi vol to record relevant information. See Figure 25. If the operator fails to record all relevant information or records incorrect information, a large red "X" is marked by the NASN coordinator in the top right corner of the Particulate Record Sheet and the error or omission is circled in red.

Step #1: Open the envelope and verify that the envelope contains a hi vol filter in a protective filter holder and a Particulate Record Sheet.

Step #2: Verify that the number on the hi vol filter is the same as recorded on the Particulate Record Sheet.

Step #3: Examine the hi vol filter for holes, missing parts, or tears causing air leaks during sampling. Void filters with these symptoms. If a filter is torn during removal from the hi vol, it is still considered a valid sample providing all filter parts are present.

Step #4: Examine the hi vol filter for a clean white margin, 1.6 mm wide or greater, all of the way around the filter. Void all filters having less than a 1.6 mm margin at any place.

Step #5: Examine the margin for sharpness. If there is not a straight, clear, readily identifiable margin then either the faceplate gasket needs replacing, or the faceplate was improperly tightened during hi vol filter installation.

Step #6: Examine the Particulate Record Sheet for missing information.

Step #7: Examine the Particulate Record Sheet remarks section for comments which may affect the interpretation of the data, or for comments regarding instrument performance and service required.

Step #8: Complete the top part of the Particulate Data Card. See Figure 26.

(a) Station Name - This can be found in Table 1.

(b) Station Code - This is the SAROAD site number. See Table 1.

(c) Agency - This is always P since this is an EPA network.

(d) Project - This will usually be 01 or 03 and can be found in Table 1.

(e) Time - This is usually "7" which designates a 24-hour sample.

(f) Sample Date - year is last two (2) digits in year (i.e., 74, 75, 76, etc.)

Q3

Budget Bureau No. 85-R0084
Expires 1-31-75

PARTICULATE RECORD SHEET

NATIONAL SURVEILLANCE NETWORK

SAMPLER SERIAL NO. 4-02-899 FILTER NO. 9999999

SITE Pedro K Heller, CA. (CITY or TOWN) Roof of Nowhere Bldg. (SAMPLER LOCATION)

WIND	VISIBILITY	SKY	HUMIDITY	TEMP. °F
N DIRECTION	☑ CLEAR	☑ CLEAR	☐ DRY	☐ <20
☐ CALM	☐ HAZY	☐ SCATTERED	☑ MODERATE	☐ 20-40
☑ LIGHT		☐ OVERCAST	☐ HUMID	☐ 41-60
☐ GUSTY			☐ RAIN	☑ 61-80
				☐ >80

DATE 75-5-31	METER READING		REMARKS & . UNUSUAL CONDITIONS OR ACTIVITIES NEAR THE SITE
☒ 0000 TO 2400 HOURS	START	60	Highway Construction nearby.
☐ OTHER EXPLAIN	END	58	

Figure 25
Particulate Record Sheet

NATIONAL AIR SURVEILLANCE NETWORK
AIR QUALITY DATA BANK RECORD
(24 Hour or Greater Sampling)
PARTICULATE DATA

Filter No.: 9999999

Station Code									Agency	Project	Time
1	1	9	9	9	9	0	0	1	P	01	7
St	Station (2-10)							Site	(11)	(12-13)	(14)

(1) Station Name: 2 Podunk Holler, GA.
Sampling Rate, m^3/min: 1.69
Site Location: Roof of Nowhere Bldg.
Sampling Time, min: 1440

Yr	Mo	Day	ST-HR
75	05	30	00
Yr (15-20)			(21-22)

	Pollutant	Method	Units	Pol Code	Method	Unit	DP	Value	Card Col.
1	Particulate		$\mu g/m^3$	11101					23-36
2	NO_3		$\mu g/m^3$	12306					37-50
3	SO_4		$\mu g/m^3$	12403					51-64
4	NH_4		$\mu g/m^3$	12301					65-78

DP = Number of digits to right of decimal

Highway Construction Nearby

Filter + Sample _____
Filter Weight _____
Sample Weight _____

Air Volume, m^3 _____

EPA(DUR)292
REV. 5-74

Figure 26
Particulate Data Card

Month is the number of the month:

Jan = 01	July = 07
Feb = 02	Aug = 08
Mar = 03	Sept = 09
Apr = 04	Oct = 10
May = 05	Nov = 11
June = 06	Dec = 12

Day is for date in month.

(g) St-Hr - This is the starting hour which is usually midnight. Since military time is used, this is usually "00".

(h) Filter No. - This is the number on the hi vol filter and the Particulate Record Sheet.

(i) Site Location - This is the address as listed in Table 1.

(j) Min. Sampled - This is the number of minutes the sample was collected. For a 24-hour sample this is 1440.

(k) Sampling Rate - This is the average of the beginning and ending flowrates.

- Refer to the Meter Readings recorded on the Particulate Record Sheet.
- Use the rotameter calibration curve to convert the rotameter readings to flowrates.
- Average the two flowrates and record the average in the Sampling Rate blank on the Particulate Data card.

Step #9: If there is a red "X" in the upper right corner of the Particulate Record Sheet, contact the cooperator to correct the error or obtain the missing information. Document in the Site Action Log and in the Remarks section of the Particulate Record Sheet the action taken and results obtained.

Step #10: If the sample is void, write "INVA" under "Value" on the Particulate Data Card. Also, record the reason in the lower left hand corner and also in the Site Action Log.

Step #11: Paper clip the Particulate Data Card to the protective holder containing the hi vol filter and forward to the laboratory.

Step #12: File the Particulate Record Sheet in the Particulate Record Sheet File by Sample Period. See Table 3.

Standard Operating Procedure for Hi Volume Air Sampler (Hi Vol)

The Hi Vol is an instrument used to collect samples of total suspended particulate (dirt) in the air. The samples are collected on an 8" x 10" glass fiber filter. A timer is used to turn the sampler ON at midnight and allow the sampler to operate 24 hours. The sampling schedule is standardized nationwide so one sample is collected nationwide once every 12 days - on the same day. A copy of the sampling schedule is attached. Materials used in the operation of the Hi Vol consist of a glass fiber filter for collecting the sample, a manila folder for protecting the filter and sample after collection, a Particulate Record Sheet for recording information about the instrument and the sample collected, and a self-addressed stamped envelope for returning the above item. A new supply of these items and sampling schedule will be provided in November or December.

If a filter from a previous run is on the sampler, start at Step A1. If the sampler is being set up for the first time or no filter is on it, start at Step B1.

Step

A1 - Locate the ON-OFF switch on the lower left hand face of the timer and turn the hi vol ON to warm up for 5 minutes.

A2 - Connect the free end of the rotameter hose to the nipple at the exhaust (bottom) end of the hi vol in the shelter.

A3 - Holding the rotameter vertically, take a reading on the scale opposite the center of the ball. Turn the hi vol OFF and record this reading under Stop flowrate on the record sheet.

NOTE: If the ball is stuck at the bottom of the rotameter, tap gently against the hi vol to free it. Also, notify the NASN coordinator of this difficulty. If the ball is at the top of the rotameter and off scale, cover the rotameter exhaust port at the top of the rotameter momentarily. This should cause the ball to drop onto the scale. If it does not turn off the hi vol, disconnect the rotameter, and notify the NASN coordinator.

A4 - On the particulate Record Sheet record the rotameter number in the Sampler Serial No. blank. In the Filter No. blank record the number stamped on the corner of the filter. Record the wind direction in the blank marked direction. Check the appropriate blocks for wind speed, visibility, sky cover, humidity and temperature. (Note: all meteorological data should be a 24-hour average for the sample date). Record the sample time in the appropriate block. Any unusual conditions, messages, etc., should be recorded in the Remarks block. Sign the record sheet.

A5 - Remove the filter holder by loosening the four wing nuts and swinging the bolts out of the way. It is not necessary to remove the wing nuts as they are easily lost.

A6 - Lift the filter from the screen carefully by the edges to assure that no filter media or sample is lost.

A7 - Fold the filter lengthwise with the sample inside. Try to line up the sides so that the filter is folded evenly.

A8 - Place the used filter in the folder provided, place with the record sheet in one of the return envelopes provided, and mail as soon as possible.

B1 - Place a new filter on the sampler with the rough side UP. The hi vol may have alignment marks on the screen. If so, fit the corners of the filter into the corners of the alignment markers.

B2 - Record the filter number on the record sheet.

B3 - Place the filter holder gasket down on the filter and uniformly tighten up the wing nuts to assure a leak free fit. Do not over tighten.

B4 - Locate the OFF switch on the lower left hand face of the timer and turn the hi vol ON to warm up for 5 minutes.

B5 - Connect the free end of the rotameter hose to the nipple at the exhaust (bottom) end of the hi vol in the shelter.

B6 - Holding the rotameter vertically, take a reading on the scale opposite the center of the ball. Turn the hi vol OFF and record this reading under start flowrate on the record sheet.

B7 - Record the date the hi vol is to be run, location etc., on the record sheet.

B8 - Set the timer to the correct time and date by turning the time disc in the direction indicated by the arrow until the correct time is under the pointer.

B9 - Set the sample run date and time trippers on the timer disc. The ON tripper is light colored and should be set for midnight before the sample date and the OFF (dark) tripper should be set for midnight at the end of the proposed sample date.

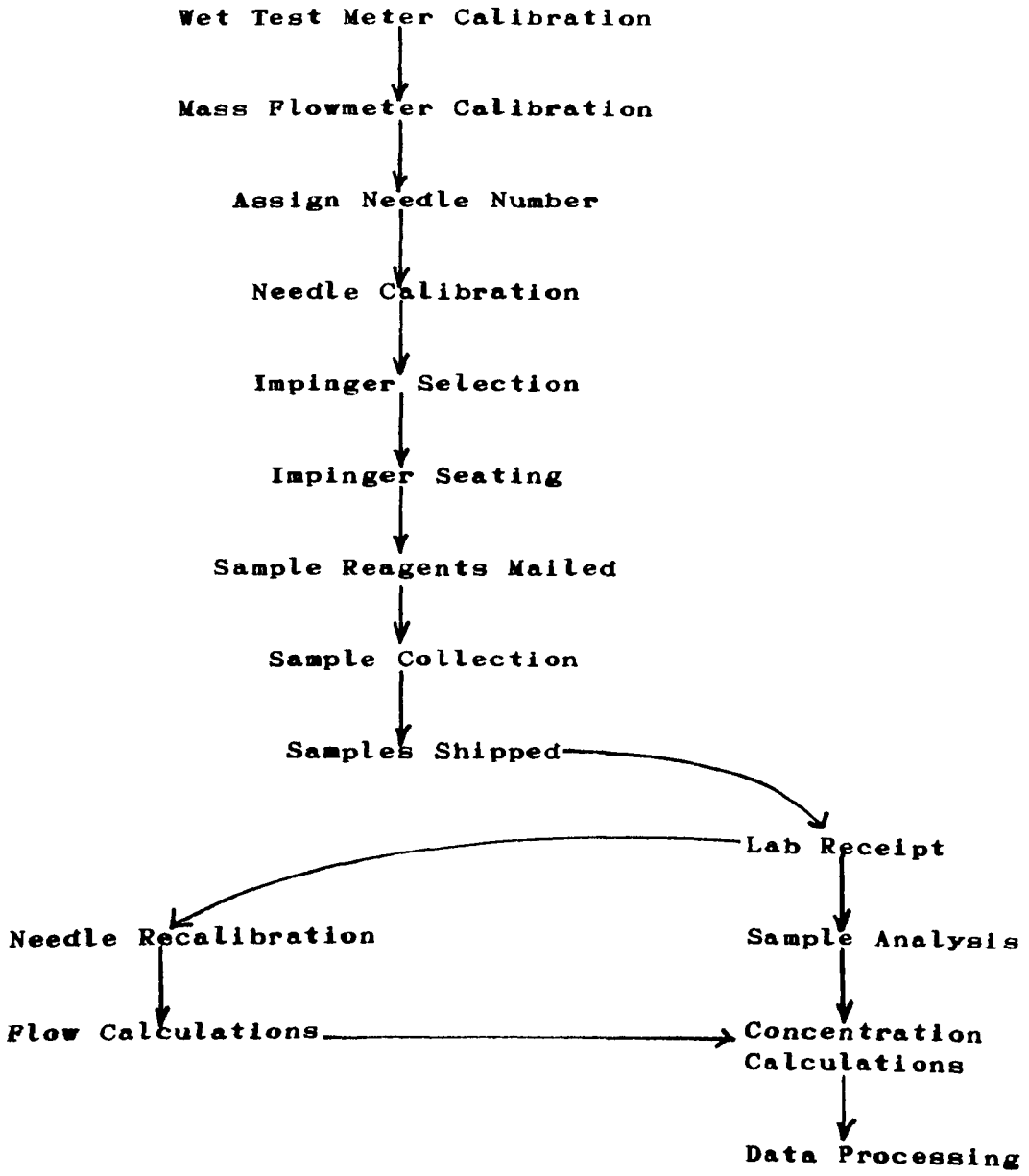
If any problems are encountered, call the NASN coordinator person-to-person collect; Mr. Jerry Burger
404-546-2297

Section III
Gas Bubbler

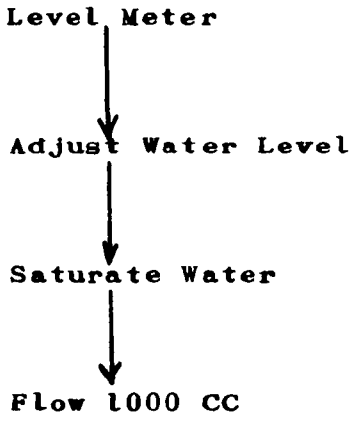
Section III
Gas Bubbler

This section contains specific information on the stepwise operation, calibration, maintenance, data handling and record keeping for Gas Bubblers. A generalized flow diagram outlining Section III is given. Each task is preceeded by a specific flow diagram and then a stepwise procedure.

Gas Bubbler


Wet Test Meter Calibration
Mass Flowmeter Calibration
Assign Needle Number
Needle Calibration
Impinger Selection
Impinger Seating
Sample Reagents Mailed
Sample Collection
Samples Shipped
Lab Receipt
Needle Recalibration
Sample Analysis
Flow Calculations
Concentration Calculations
Data Processing

Wet Test Meter Calibration



Step #1: Level the wet test meter by adjusting the legs until the bubble is centered in the level located on top of the meter.

Step #2: Adjust the water volume in the wet test meter until the pointer in the water level gage just touches the meniscus.

Step #3: Flow air through the wet test meter for 2 hours before calibration at a flowrate of approximately 200 cc/min.

Step #4: Set up the apparatus as shown in Figure 27.

- Fill the 1 gallon jug with water to just below the air inlet tube (short).
- Start water siphoning through the long tube and valve. When this hose is devoid of air bubbles stop.

Step #5: Disconnect the wet test meter from the pump.

Step #6: Connect the air inlet tube of the jug to the outlet on the wet test meter.

Step #7: Adjust the water manometer to zero by moving the scale or adding water if necessary.

Step #8: Move the pointer to zero by venting water through the valve into a beaker. See Figure 27.

Step #9: Place a clean dry 1000 ml volumetric flask under the valve and drain in water from the jug until the meniscus is at the 1000 ml line on the volumetric flask. While the water is flowing, record the wet test meter manometer reading in the Wet Test Meter Calibration Log. See Figure 28.

- If the manometer reading is less than 10 mm proceed to step 10 below.
- If the manometer reading is greater than 10 mm, the wet test meter is defective.

Step #10: Read and record the wet test meter reading indicated by the pointer.

Step #11: Repeat Steps 7-10 above twice.

Step #12: Average the three values recorded in Step 10 above and mark the wet test meter face at this average value. This corresponds to the actual point corresponding to 1 liter.

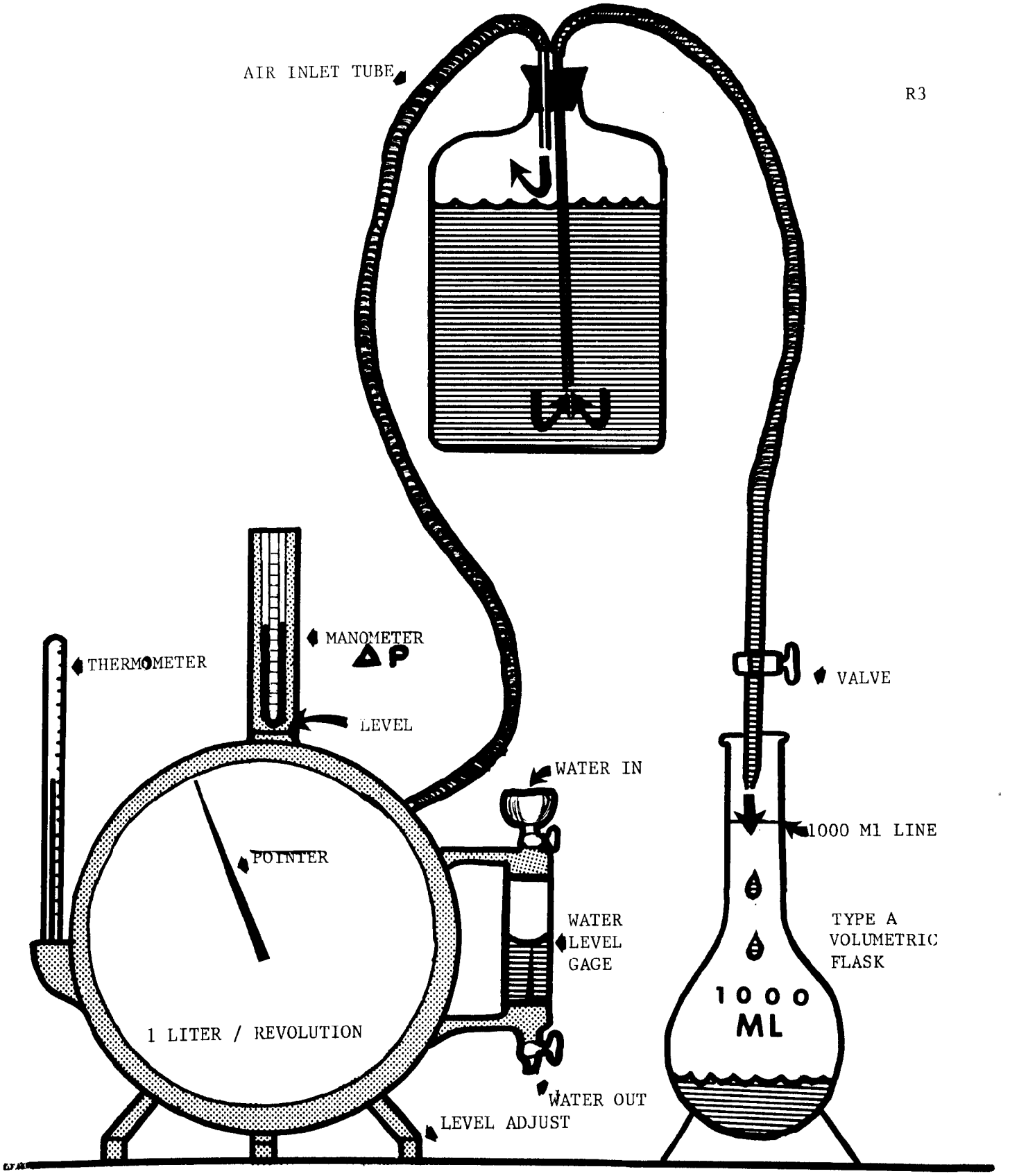


Figure 27
Wet Test Meter Calibration Apparatus

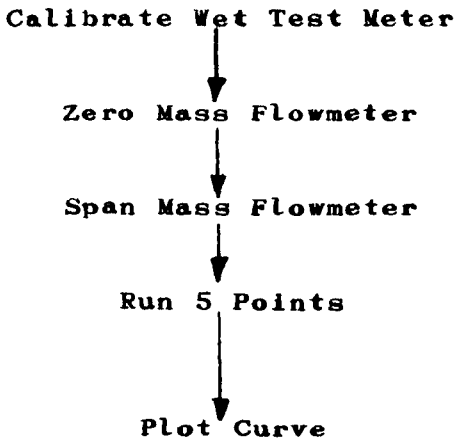
SERIAL # 17739
Date June 10, 1975
Temp. 23°C
BAR. PRESSURE 751.0 mm Hg
VOL. PER REV. 1 LITER
VOL. OF Std. 1 LITER (± 0.30 mL)
By Jerry W. Burger

Readings

Wet Test Meter	Standard	ΔP
1.009	1 LITER	<0.1
1.003	1 LITER	<0.1
1.003	1 LITER	<0.1

Figure 28
Wet Test Meter Calibration Log

Mass Flowmeter Calibration



Mass Flowmeter Calibration

This procedure is to be used with a 0-300 cc/min mass flowmeter.

Step #1: Adjust the screw just below the meter face so the needle is on zero. This is performed with the mass flowmeter turned OFF.

Step #2: Turn the mass flowmeter ON and allow it to warm up for two hours. Perform step #3 during warm-up.

Step #3: Calibrate the wet test meter.

Step #4: Set up the calibration apparatus as shown in Figure 29.

Step #5: Two hours after Step #2 is performed, zero the mass flowmeter with the adjust trimmer on the lower right front of the instrument.

- Unscrew the plastic knob cover.
- Plug the inlet and outlet of the transducer so no air will flow through it.
- Adjust the screw so the needle reads zero.
- Unplug the inlet and outlet of the transducer and connect it as illustrated in Figure 29.

Step #6: Span the mass flowmeter with a 22 gauge 1/2" long needle.

- Turn the vacuum pump ON.
- Assure a vacuum of at least 20 on the vacuum gauge.
- Wait three minutes and read the mass flowmeter.
  - If the mass flowmeter does not read between 250 and 290 cc/min replace the needle.
  - If the mass flowmeter reads less than zero the transducer is connected backwards.
- Start a stopwatch when the wet test meter pointer indicates zero.
- Record 1000 in column V_1 in the Mass Flowmeter Calibration log. See Figure 30.
- Record the mass flowmeter reading in column "Mass Flowmeter Scale" in the Mass Flowmeter Calibration Log when the wet test meter pointer indicates 800 cc.
- Stop the stopwatch when the wet test meter pointer indicates 1000 cc.

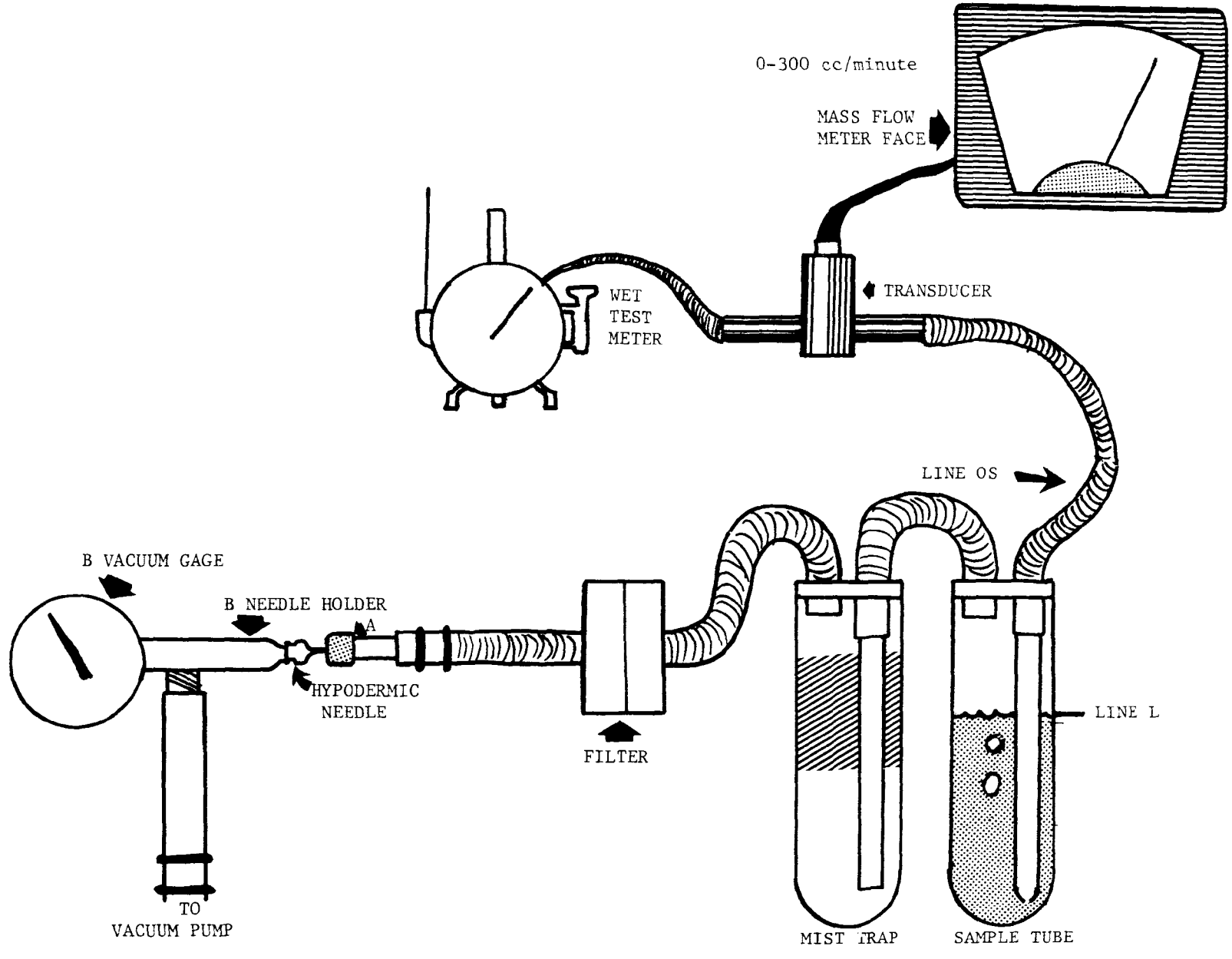


Figure 29
Mass Flowmeter Calibration Apparatus

- Record the time in minutes in column M.

Step #7: Record the air temperature in ^{o}C under column Tc. Record the barometric pressure in mm under column P_1.

Step #8: Calculate and record T_1 from Tc by adding 273.

Step #9: Calculate and record V_2 from P_1, V_1, and T_1

$$V_2 = 0.392 \left(\frac{P_1 \ V_1}{T_1} \right)$$

Step #10: Calculate and record flow rate Q from V_2 and M

$$Q = \frac{V_2}{M}$$

Step #11: Plot Q vs. measured flowrate from the mass flowmeter.

Step #12: Repeat steps 6-11 for 5 other needles with flowrates between 170 and 230 cc/min.

Step #13: Draw a best fit curve for the points generated.

Step #14: Complete the Mass Flowmeter Calibration Log. See Figure 30.

Description Derivation	Temperature in ^{o}C of air in positive displacement standard	Absolute Temperature Tc + 273	Barometric Pressure	Uncorrected Volume Passed through Standard in CC	$\frac{P_1V_1}{T_1}$ .392	Time In Minutes	Flowrate $\frac{V_2}{M}$	Mass Flowmeter
Symbol / Run #	TC	T_1	P_1	V_1	V_2	M	Q	Scale
1A								
1B								
2A								
2B								
3A								
3B								
4A								
4B								
5A								
5B								

Date_____ Serial # of standard _____
Time_____ Serial # of mass flowmeter _____
Range of mass flowmeter _____

Figure 30
Mass Flowmeter Calibration Log

Needle Number Assignment

Each needle used in the gas bubbler system is assigned an identification number which is inscribed permanently into the needle body. The base of the needle is color coded to identify which needles are designated for use in SO_2 and which are designated for use in NO_2 sampling. Once a needle with an assigned number is destroyed, this is recorded as appropriate in the SO_2 or NO_2 Needle Log and that same number is assigned to a new needle.

The numbering system consists of one letter (either S or N), a two digit number (from 01 to 99) and one letter (from A to Z). There is no difference in the needles used for SO_2 or NO_2 sampling. However, the needles used for SO_2 sampling are designated with a prefix of S. The needles used for NO_2 sampling are designated with a prefix of N. This is an aid to minimize mix up of needles and identify when a mix up has occurred.

The needle is assigned a chronological number from 01 to 99. Due to the lack of space on the needle for infinitely long numbers, a letter is assigned as a suffix. The first 99 needles numbered would have the suffix of A; the second 99 needles would have a suffix of B; the third 99 needles would have a suffix of C; etc.

The needles have a color coded band around the base to identify to the operator which is an SO_2 needle and which is an NO_2 needle. SO_2 needles are color coded blue and NO_2 needles are color coded red.

Step #1: Assign a new or previously discontinued number to a needle that falls within the flow rate range of 190 to 210 cc/min.

Step #2: Scribe this number on the needle with an electric engraver as shown in Figure 31.

Step #3: Place the appropriate colored heat shrink tubing around the needle base as shown in Figure 31 and shrink in place with a heat gun.

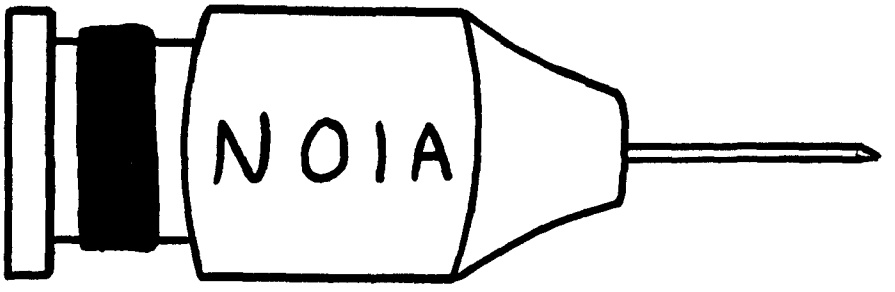
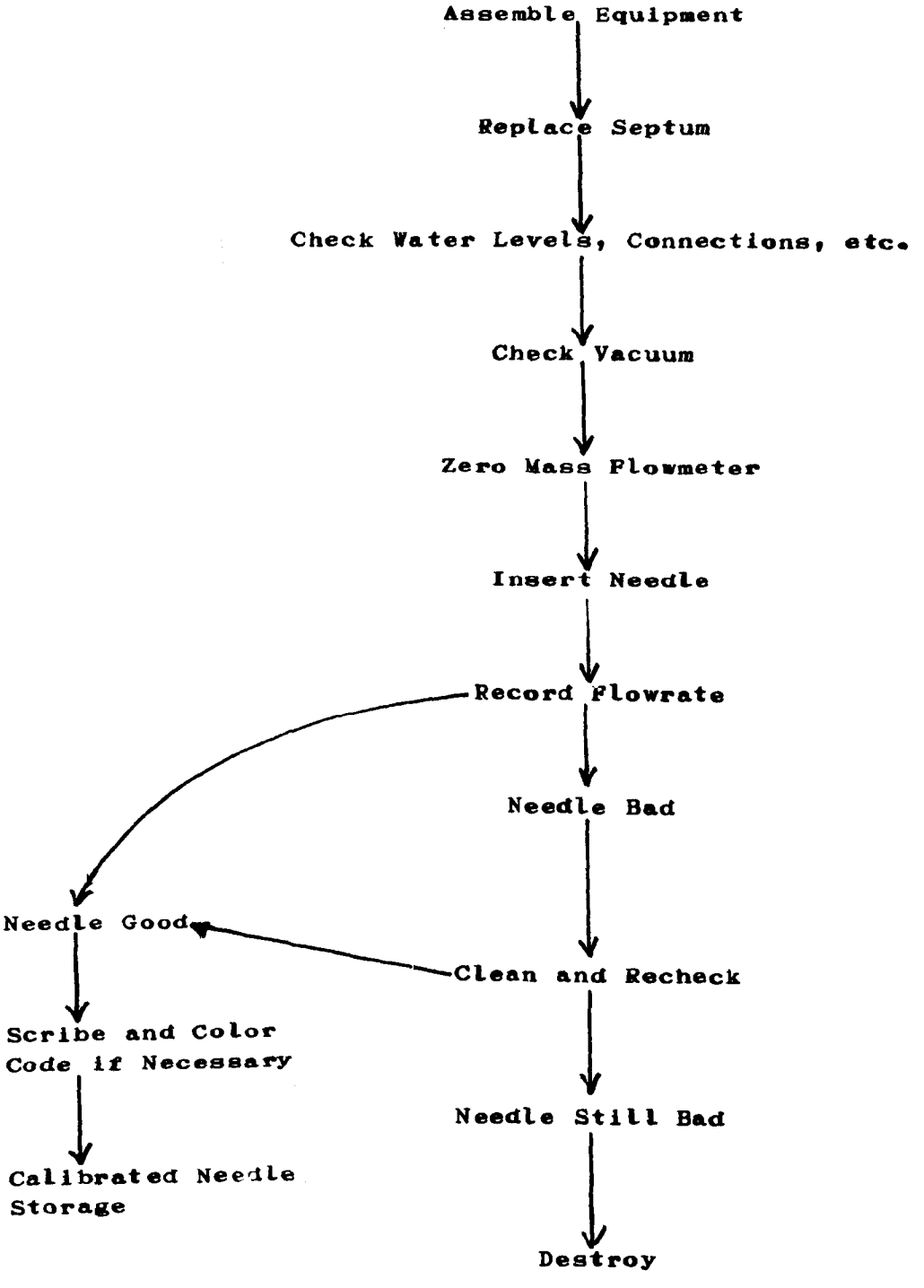


Figure 31
Inscribed Needle Number


Assemble Equipment
Replace Septum
Check Water Levels, Connections, etc.
Check Vacuum
Zero Mass Flowmeter
Insert Needle
Record Flowrate
Needle Bad
Needle Good
Clean and Recheck
Scribe and Color Code if Necessary
Needle Still Bad
Calibrated Needle Storage
Destroy

Needle Calibration

Step #1: Assemble the equipment as shown in Figure 32.

Step #2: Place a new serum stopper on the tube at "A".

Step #3: Adjust the water level in the sample tube to line L if necessary.

Step #4: Assure tightness of all connections.

Step #5: Assure line OS is connected to the mass flowmeter transducer outlet and to the sample tube impinger side.

Step #6: Turn the vacuum pump ON and check the vacuum by placing a finger over the end of the tube. At "B" the vacuum gage should read at least 20. Turn the vacuum pump OFF.

Step #7: Zero the mass flowmeter.

Step #8: Insert a needle through septum A as shown in Figure 32. The needle should be inserted in the septum center perpendicular to the plane of the face of the septum.

Step #9: Turn the vacuum pump ON.

Step #10: Slide needle holder B snugly into the recess at the base of the needle (See Figure 32). Check for bubbles in the sample tube.

Step #11: Read the flowrate from the mass flowmeter after stabilization.

(a) If the needle has an assigned number, record the flowrate in the appropriate SO_2 or NO_2 Needle Log. See Figures 33 and 34.

- If the needle has visible physical damage, destroy it.
- If the flowrate exceeds 210 cc/min, destroy it.
- If the flowrate is below 190 cc/min, clean it with a wire and acetone and recheck the flowrate.
- If the needle has no visible physical damage and has a flowrate within the range of 190 to 210 cc/min, place the needle in a protective container and place it in the calibrated needle storage area.
- Record the action taken with each needle.

(b) If the needle does not have an assigned number, inspect the needle for physical damage. Return damaged needles to the manufacturer for credit.

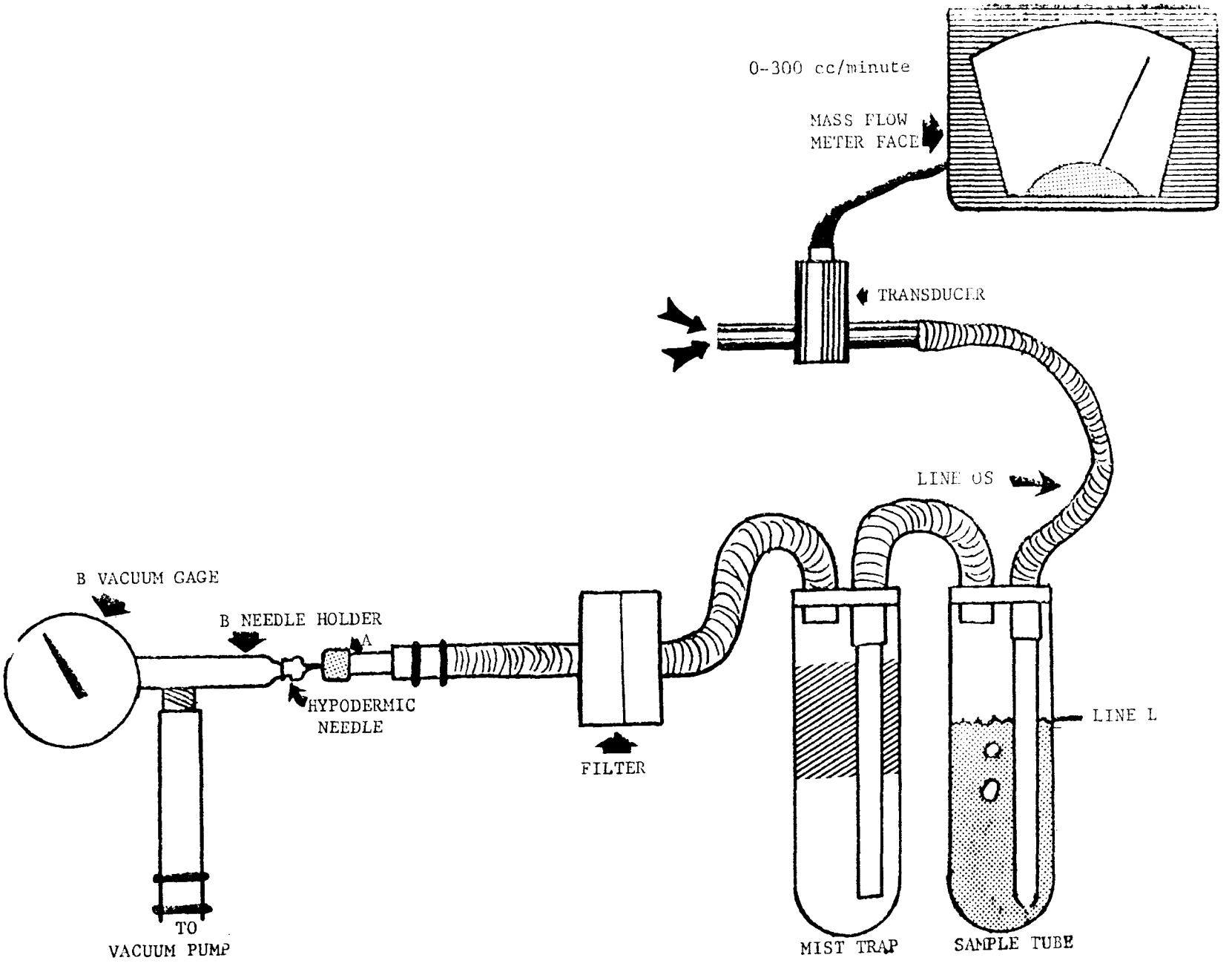


Figure 32
Needle Calibration Apparatus

- If the flowrate exceeds 210 cc/min, destroy it.
- If the flowrate is below 190 cc/min, clean it with a wire and acetone and recheck the flowrate.
- If the needle has no physical damage and has a flowrate within the range of 190 to 210 cc/min, assign a number according to the procedure outlined in the SO_2 or NO_2 Needle Log.
- Record the flowrate.
- Place the needle in a protective container and place it in the calibrated needle storage area.

#NO1A

Flow	Date	By	
190	1/7/74	Jerry W. Burger	
180	1/16/74	Jerry W. Burger	Cleaned
192.5	2/14/74	Jerry W. Burger	
204	5/10/74	Jerry W. Burger	
205	6/26/74	Jerry W. Burger	
218	10/3/74	Jerry W. Burger	Replaced
207	10/25/74	Jerry W. Burger	
220	12/4/74	Jerry W. Burger	Replaced
210	12/13/74	Jerry W. Burger	
209	1/21/75	Jerry W. Burger	
212	3/11/75	Jerry W. Burger	Replaced
199	4/9/75	Jerry W. Burger	
195	5/27/75	Jerry W. Burger	

Figure 33
NO_2 Needle Log

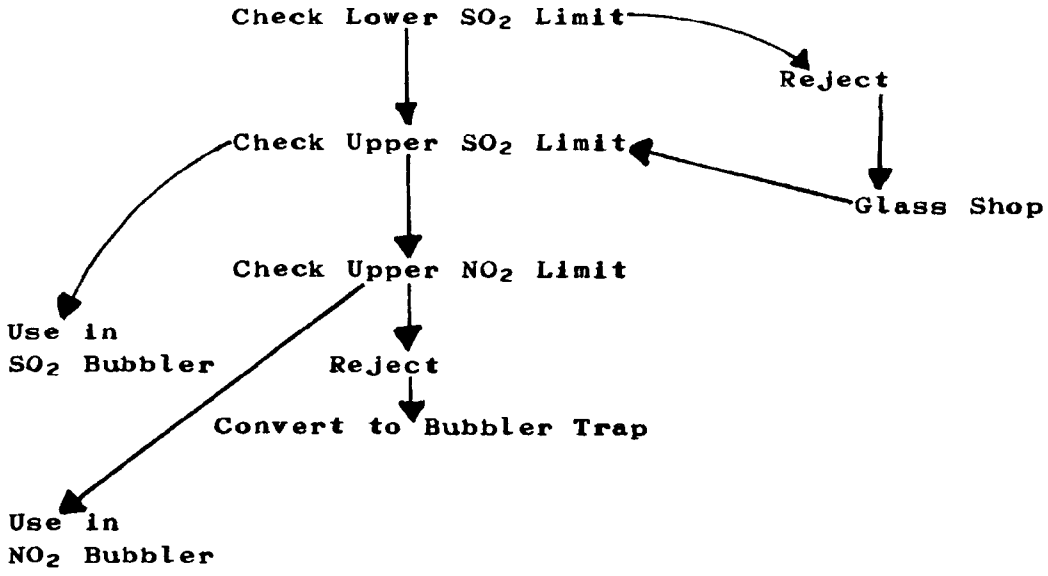
#501A

U6

Flow	Date	By	
195	1/3/74	Jerry W. Burger	
195	2/14/74	Jerry W. Burger	
195	5/9/74	Jerry W. Burger	
204	6/25/74	Jerry W. Burger	
208	8/5/74	Jerry W. Burger	
210	9/9/74	Jerry W. Burger	
215	10/3/74	Jerry W. Burger	Replaced
205	10/16/74	Jerry W. Burger	
215	12/13/74	Jerry W. Burger	Replaced
210	12/13/74	Jerry W. Burger	
210	1/21/75	Jerry W. Burger	
183	3/11/75	Jerry W. Burger	Replaced
192	4/9/75	Jerry W. Burger	
199	5/7/75	Jerry W. Burger	

Figure 34
SO_2 Needle Log

Impinger Selection



Impingers used for SO_2 sampling must have an orifice I.D. between 0.368 and 0.406 mm. Impingers used for NO_2 sampling must have an orifice I.D. between 0.4 and 0.8 mm. Impinger orifice gages are not commercially available. Figure 35 shows an impinger orifice gage which can be easily constructed. The number 68, 78 and 79 drills are available from machinist suppliers.

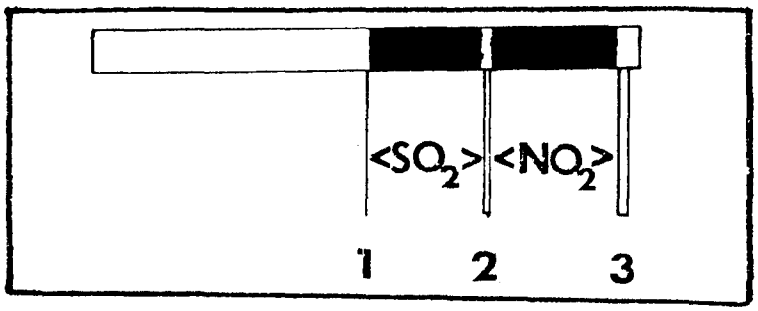
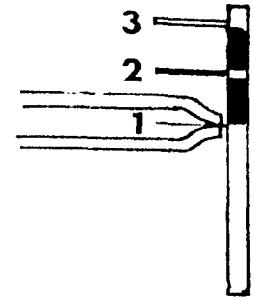
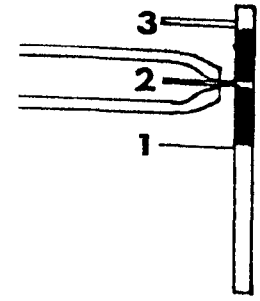
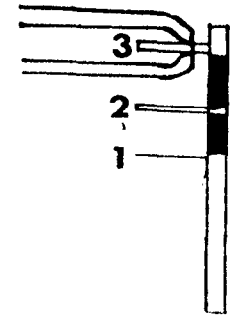


Figure 35
Impinger Orifice Gage







Step #1: Insert wire #1 (the lower limit for SO_2) into the orifice at the small end of the impinger. If it will fit, got to Step #2. If not, return it to the glass shop for enlargement.

Step #2: Insert wire #2 (the lower limit for NO_2 and upper limit for SO_2) into the orifice at the small end of the impinger. If it does not fit, it is a good SO_2 impinger, It if does fit, got to Step #3.

Step #3: Insert wire #3 (the upper limit for NO_2) into the orifice at the small end of the impinger. If it doesn't fit, it is a good NO_2 impinger. If it does fit, reject the impinger as too large.

Step #4: Use impingers rejected in Step 3 in the bubbler traps.

Impinger Seating

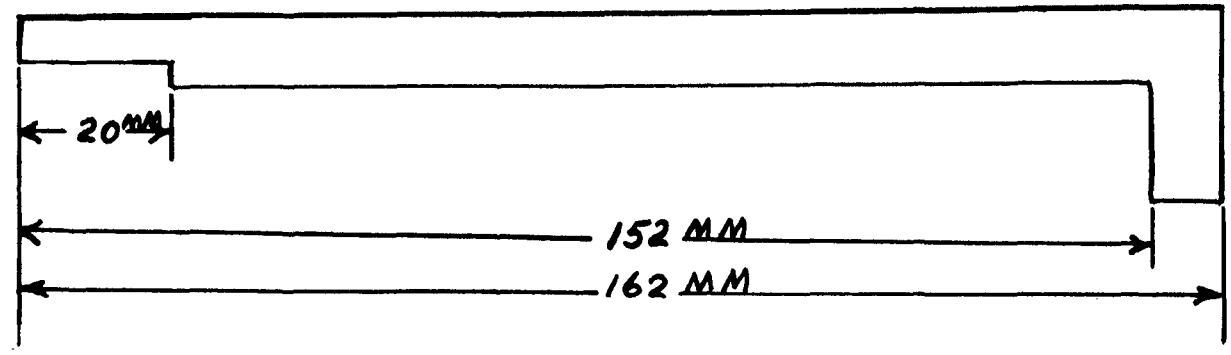
Impingers are to be seated to give a length of 152 mm below the lip of the centrifuge tube. Impinger Seating Gages are not commercially available. Figure 36 shows an impinger seating gage which can be easily constructed.

Step #1: Immerse the two hole plastic cap in boiling water to expand and soften the plastic.

Step #2: Insert the large end of an impinger into the long tube of the plastic cap as shown in Figure 36.

Step #3: Return the assembly to the boiling water to soften before final adjustment.

Step #4: Press the impinger into the plastic cap until the gage seats against the lip of the plastic cap.



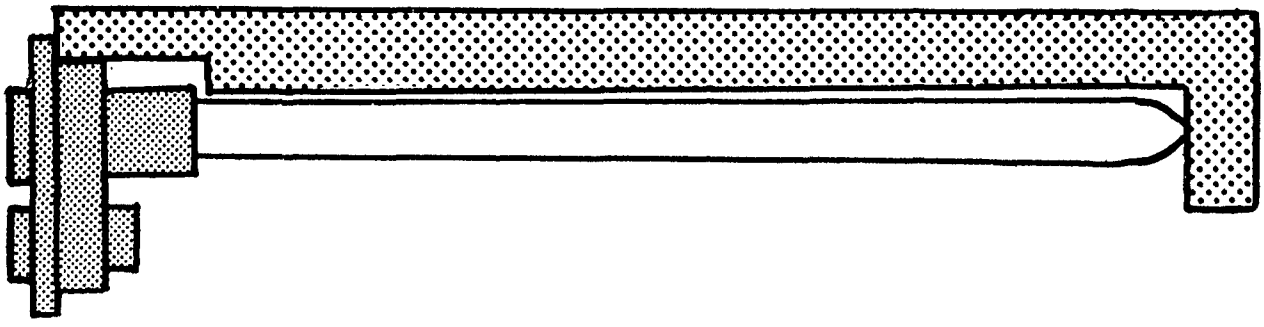
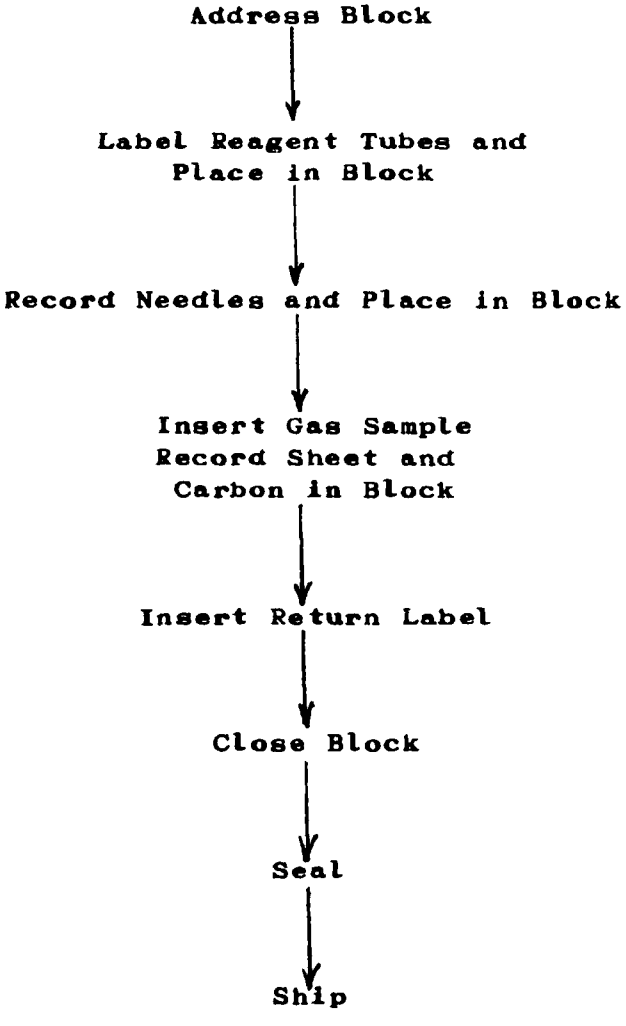


Figure 36
Impinger Seating Gage

Bubbler Mailing



Bubbler Mailing

On each of the mailing dates specified, the following will be mailed to each of the cooperators in the NASN gas sampling program in Region IV.

I. MAILING BLOCK

- 1 tube containing 50 ml of NO_2 absorbing reagent obtained from the laboratory.
- 1 tube containing 50 ml of SO_2 absorbing reagent obtained from the laboratory.
- 2 calibrated needles; one with a red band for NO_2 and one with a blue band for SO_2.
- 1 double copy Gas Sample Record Sheet.
- 1 8"x5" sheet of carbon paper.
- 1 return addressed franked label.

II. PROCEDURE

Step #1: At the start of each month, secure enough mailing labels for all shipments for that month. See Figure 37 for a page of preprinted peel-off mailing labels.

Step #2: Stamp the sample data on the NO_2 - AB and SO_2 labels as shown in Figure 37.

Step #3: With a red felt tip pen, mark the NO_2 - AB labels along both margins.

Step #4: With a blue felt tip pen, mark the SO_2 labels along both margins.

Step #5: Paint the top half of the cap on the impinger side. See Figure 38. (Red for NO_2 and blue for SO_2).

Step #6: Press the small and large caps down to assure tightness.

Step #7: Secure the caps in place by heat shrinking tubing around the tube and cap.

Step #8: Remove an address label from the label sheet and stick it to the mailing block.

Step #9: Remove the corresponding NO_2 - AB Label. Stick it to the heat shrink tubing around the NO_2 absorbing reagent (red code) and slip it into the mailing block.

Step #10: Remove the corresponding SO_2 label. Stick it to the heat shrink tubing around the SO_2 absorbing reagent (blue code) and slip it into the mailing block.

Mr. Kenneth Hall
Jefferson Co. Dept. of Health
1912 Eighth Ave.
Birmingham, AL 35203

Mr. James E. Fibbe
Air Pollution Control Div.
Mobile County Board of Health
248 Cox St.
Mobile, AL 36604

Mr. A. M. Allison
Montgomery Co. Health Dept.
P. O. Box 4008
Montgomery, AL 36104

Mr. Kappelmann
Con. City of Jacksonville
Air Pollution Control
515 W. 6th St.
Jacksonville, FL 32206

Mr. Colin A. Morrisey
Dade County Pollution Control
909 SE 1st Street
Miami, Fl 33127
Attn: John Dickerson

Glenn Greer
Dept. Of Env. Affairs, City
Of St. Petersburg
P.O. Box 2842
St. Petersburg,FL 3373]

Mr. Richard Bowman
Hillsborough Co. Poll. Control
305 Morgan St.
Tampa, FL. 33602

Mr. John Symes
Florida Dept. Pollution Control
225 SW Ave. "D", P.O.B. 9205
Winter Haven, FL 33880

Mr. B. T. Garland
Fulton County Health Dept.
99 Butler St., S.E.
Atlanta, GA 30303

Mr. Donald M. Walters
Muscogee County Health Dept.
P. O. Box 2299
Columbus, GA 31902

SO_2
Samp. Date: JUN 2 3 1975
Sta. #: 01 0380 003

SO_2
Samp. Date: JUN 2 3 1975
Sta. #: 01 2380 001

SO_2
Samp. Date: JUN 2 3 1975
Sta. #: 01 2460 001

SO_2
Samp. Date: JUN 2 3 1975
Sta. #: 10 1960 002

SO_2
Samp. Date: JUN 2 3 1975
Sta. #: 10 2700 002

SO_2
Samp. Date: JUN 2 3 1975
Sta. #: 10 3980 002

SO_2
Samp. Date: JUN 2 3 1975
Sta. #: 10 4360 002

SO_2
Samp. Date: JUN 2 3 1975
Sta. #: 10 1680 001

SO_2
Samp. Date: JUN 2 3 1975
Sta. #: 11 0200 001

SO_2
Samp. Date: JUN 2 3 1975
Sta. #: 11 1280 001

NO_2 AB X3
Samp. Date: JUN 2 3 1975
Sta. #: 01 0380 003

NO_2 AB
Samp. Date: JUN 2 3 1975
Sta. #: 01 2380 001

NO_2 AB
Samp. Date: JUN 2 3 1975
Sta. #: 01 2460 001

NO_2 AB
Samp. Date: JUN 2 3 1975
Sta. #: 10 1960 002

NO_2 AB
Samp. Date: JUN 2 3 1975
Sta. #: 10 2700 002

NO_2 AB
Samp. Date: JUN 2 3 1975
Sta. #: 10 3980 002

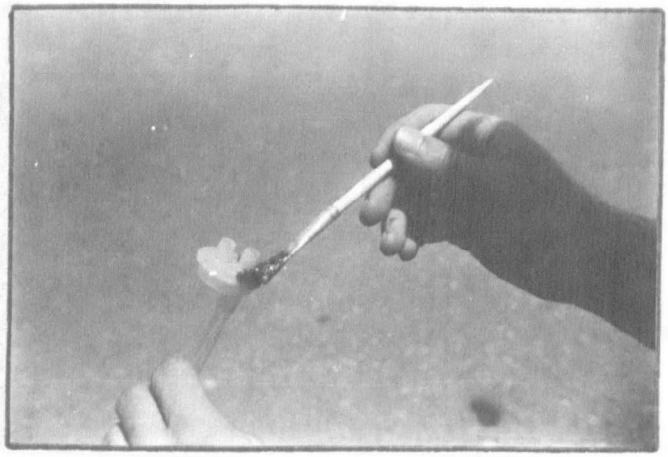
NO_2 AB
Samp. Date: JUN 2 3 1975
Sta. #: 10 4360 002

NO_2 AB
Samp. Date: JUN 2 3 1975
Sta. #: 10 1680 001

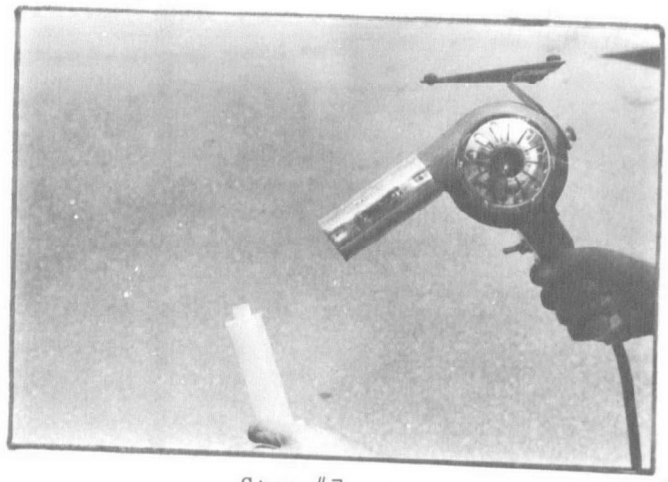
NO_2 AB
Samp. Date: JUN 2 3 1975
Sta. #: 11 0200 001

NO_2 AB
Samp. Date: JUN 2 3 1975
Sta. #: 11 1280 001

Figure 37
Mailing Labels



Step #5
Color Coding The Impinger



Step #7
Shrinking Tubing In Place

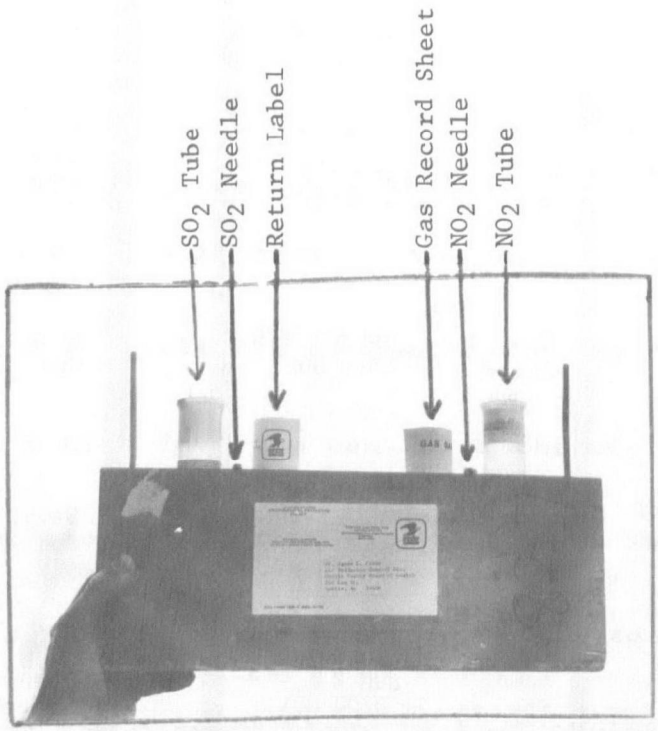


FIGURE 38

BUBBLER MAILING

Budget Bureau No. 85-R0084
Expires 1-31-75
X5

GAS SAMPLE RECORD SHEET

NATIONAL AIR SURVEILLANCE NETWORK

SAMPLER SERIAL NO. _____ **BLOCK** NO. _____

SITE _____ (CITY or TOWN) _____ (SAMPLER LOCATION)

WIND	VISIBILITY	SKY	HUMIDITY	TEMP. °F
_____ DIRECTION ☐ CALM ☐ LIGHT ☐ GUSTY	☐ CLEAR ☐ HAZY	☐ CLEAR ☐ SCATTERED ☐ OVERCAST	☐ DRY ☐ MODERATE ☐ HUMID ☐ RAIN	☐ <20 ☐ 20-40 ☐ 41-60 ☐ 61-80 ☐ >80

DATE _____	METER READING			REMARKS & UNUSUAL CONDITIONS OR ACTIVITIES NEAR THE SITE
		OPEN	CLAMP	
☐ 0000 TO 2400 HOURS	START			
☐ OTHER EXPLAIN	END			

FIGURE 39

Gas Sample Record Sheet

Step #11: Take one blue banded calibrated needle, write the needle number in the remarks section of the Gas Sample Record Sheet, and place it in the hole beside the SO_2 tube.

Step #12: Take one red banded calibrated needle, write the needle number in the remarks section of the Gas Sample Record Sheet, and place it in the hole beside the NO_2 tube.

Step #13: Fold a sheet of carbon paper with two copies of the Gas Sample Record Sheet. See Figure 39.

Step #14: Roll the Gas Sample Record Sheet into a tube and insert it into a hole in the mailing block.

Step #15: Place a franked address return label in one hole in the mailing block.

Step #16: Close the mailing block and attach the wing nuts.

Step #17: Tighten the wing nuts securely.

Step #18: Seal the mailing block with a sample date label. See Figure 40.

This sample should be run on:

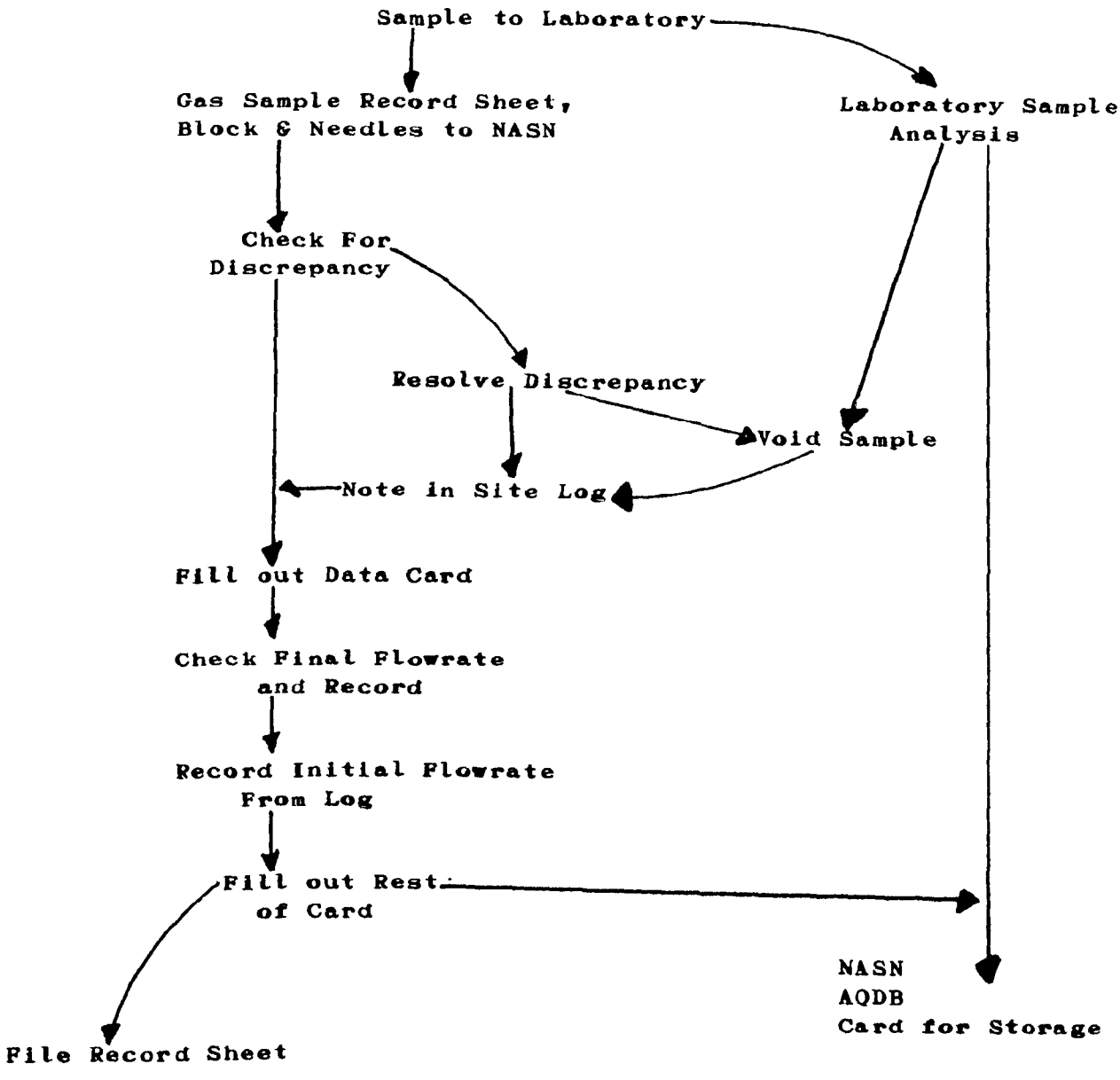
JUN 2 3 1975

Figure 40
Sample Date Label

Step #19: Stamp the sample date on the sample date label.

Step #20: Mail the block.

Bubbler Data Handling



Bubbler Data Handling

The Gas Sample Record Sheet is used by the person who operates the gas bubbler to record relevant information. If the operator fails to record all relevant information or records incorrect information, a large red "X" is marked by the NASN coordinator in the top right corner of the Gas Sample Record Sheet and the error or omission is circled in red.

When the sample returns from the field, it goes first to the laboratory where the samples are removed and the samples are logged in. Any discrepancy in the sample or recordkeeping is noted. If anything is observed, a large red X is placed on the upper right hand corner of the gas sample record sheet for ultimate resolving by the NASN coordinator. Next the mailing block complete with the gas sample record sheet and needles used on the run are transferred to the NASN coordinator.

Step #1: Open the mailing block and check for the presence of two needles and the Gas Sample Record Sheet.

Step #2: Verify that the needles in the mailing block are the same as recorded in the remarks column of the Gas Sample Record Sheet.

Step #3: Measure the flowrate of each needle and record these flowrates as the ending flowrates in the appropriate needle calibration book.

Step #4: Examine the Gas Sample Record Sheet for missing information.

Step #5: Examine the Gas Sample Record Sheet for comments which may affect the interpretation of the data, or for comments regarding instrument performance and service required.

Step #6: Place the needles in a protective cover and place in the calibrated needle storage area.

Step #7: Prepare the Gas Data Card. See Figure 41.

(a) Station Name - This can be found in Table 1.

(b) Station Code - This is the SAROAD site number. See Table 1.

(c) Agency - This is always P since this is an EPA network.

(d) Project - This will usually be 01 or 03 and can be found in Table 1.

(e) Time - This is usually "7" which designates a 24-hour sample.

(f) Sample Date-

Year is last two digits in year (i.e., 74, 75, 76, etc.)

Month is for the number of the month:

Jan	= 01	July	= 07
Feb	= 02	Aug	= 08
Mar	= 03	Sept	= 09
Apr	= 04	Oct	= 10
May	= 05	Nov	= 11
June	= 06	Dec	= 12

Day is for date in month.

(g) St-Hr. - This is the starting hour which is usually midnight. Since military time is used, this is usually "00".

(h) Site Location - This is the address as listed in Table 1.

(i) Turn the Gas Data Card over and record the sampling period in the blank identified as "Period" in Table 3.

(j) Time - This is the number of minutes the sample was collected. For a 24-hour sample this is 1440.

(k) Transcribe the pump vacuum reading from the Gas Sample Record Sheet in the boxes marked "meter reading" to the Gas Data Card. If the vacuum reading is less than 18, void the sample and ship a new pump to the site.

(l) Transcribe the meteorological observations from the Gas Sample Record Sheet to the Gas Data Card.

(m) Transcribe the laboratory identification number from the top left corner of the Gas Sample Record Sheet to the Gas Data Card Remarks section.

(n) Transcribe the "start" and "end" flowrates from the SO_2 and NO_2 Needle Logs to the Gas Data Card.

(o) Determine the average NO_2 and SO_2 flowrates and record in the "average" column.

(p) If the sample is void, write "INVA" under "Value" on the Gas Data Card. Also, record the reason in the Remarks section and in the Site Action Log.

Step #8: If there is a red "X" in the upper right corner of the Gas Sample Record Sheet, contact the cooperator to correct the error or obtain the missing information. Document in the Site Action Log and in the Remarks section of the Gas Sample Record Sheet the action taken and results obtained.

Step #9:: Forward the Gas Data Card to the laboratory.

Step #10: File the Gas Sample Record Sheet in the Gas Sample Record Sheet File by Sample Period. See Table 3.

NATIONAL AIR SURVEILLANCE NETWORKS
AIR QUALITY DATA BANK RECORD
GAS DATA

Y5

Station Code									Agency	Project	Time
1	1	9	9	9	7	0	0	1	F	0	7
St		Station (2 - 10)				Site			(11)	(12 - 13)	(14)

(2) Pedrick Hollow, Co.
STATION NAME

(1) Roof of Nowhere Bldg.
SITE LOCATION

Yr	Mo	Day	ST-HR
7 5	0 5	3 0	0 0
Yr (15 - 20)			(21 - 22)

	POLLUTANT	METHOD	UNITS	POL. CODE	METHOD	VALUE	DP	CARD COL
1	NO_2	ARSENITE	$\mu g/m^3$	4 2 6 0 2	9 4			23 - 36
2			$\mu g/m^3$					37 - 50
3			$\mu g/m^3$					51 - 64
4	SO_2	REFERENCE (P-ROSANILINE)	$\mu g/m^3$	4 2 4 0 1	9 1			65 - 78

Front

DP-Number of digits to right of decimal.

PERIOD M TIME (min) 1440

TUBE NO.	GAS	LIQUID LEVEL	FLOW RATE START	FLOW RATE END	FLOW RATE AVE	TOTAL AIR VOLUME m^3	$\mu g/mL$ GAS	$\mu g/m^3$ GAS
1	NO_2		200	202	201			
2								
3								
4	SO_2		198	200	199			

PUMP
☐ < 20 ☑ > 20

WIND
☑ DIRECTION N
☐ CALM
☑ LIGHT
☐ GUSTY

VISIBILITY
☑ CLEAR
☐ HAZY

SKY
☑ CLEAR
☐ SCATTERED
☐ OVERCAST

HUMIDITY
☐ DRY
☑ MODERATE
☐ HUMID
☐ RAIN

TEMP. °F
☐ < 20
☐ 20-40
☐ 41-60
☑ 61-80
☐ > 80

Remarks: 1130

Highway Construction Nearby

26-284

Back

Figure 41
Gas Data Card

Gas Bubbler Standard Operating Procedure

The gas bubbler is an instrument used to collect samples of gaseous pollutants in the air. The samples are collected by bubbling air through specific liquid reagents. A timer is used to turn the sampler ON at midnight and allow the sampler to operate for 24 hours. The sampling schedule is standardized nationwide so one sample is collected nationwide once every 12 days--on the same day. A copy of the sampling schedule is attached. Materials used in the operation of the gas bubbler consist of sample tubes for collecting the samples, hypodermic needle for controlling flowrates, a gas sample record sheet for recording information about the instrument and the sample collected, and a mailing block for transport of the sample tubes to and from the site.

A new mailing block will be supplied at least one week before the sample date. If none is received call the NASN coordinator, Mr. Jerry Burger, person-to-person collect at 404/546-2297 to receive a new sample.

If a sample or tube from a previous run is on the sampler, start at step A1. If the sampler is being set up for the first time or no sample is on the sampler start at Step B1.

Step

A1: Locate the ON-OFF switch on the lower left face of the timer and turn the pump ON to check the vacuum and verify flow by checking for bubbles in the sample tubes.

A2: Record the vacuum gage reading on the Gas Sample Record Sheet under "Meter reading END OPEN".

A3: Clamp the vacuum hose.

A4: Record the vacuum gage reading under "meter reading END CLAMP."

A5: Open the clamp and turn the pump OFF.

A6: Remove the NO_2 (red) needle from the bubbler and place it in the return mailing block.

A7: Remove the NO_2 sample tube from the bubbler and cover the two holes with the small caps. Tighten down the caps to prevent leakage in shipment.

A8: Place the NO_2 sample tube in the return mailing block.

A9: Repeat steps A6, 7 and 8 for the SO_2 (blue) needle and sample tube.

A10: Fill out the meteorological data on the Gas Sample Record Sheet for the sampling date.

A11: Assure that the site location and date is recorded on the Gas Sample Record Sheet.

A12: Insert the original copy of the Gas Sample Record Sheet into an empty hole in the mailing block.

A13: Close the mailing block and tighten the wing nuts with the special wrench provided.

A14: Attach the franked addressed label to the block and mail.

Step

B1: Open the mailing block.

B2: Verify that the block contains two copies of a Gas Sample Record Sheet with carbon paper, one NO_2 sample tube with flow control needle, and one SO_2 sample tube with flow control needle.

B3: Place the NO_2 sample tube in the empty space in the bubbler rack.

B4: Take the two small caps off the holes in the top of the sample tube.

B5: Attach the accordian tubing tightly to the hole on the colored side of the tube top.

B6: Attach the smooth tubing tightly to the hole on the unmarked side of the tube top.

B7: Insert the NO_2 (red) needle into the center of the red rubber septum on the NO_2 assembly perpendicular to the plane of the face of the septum as illustrated in Figure 42.

B8: Slide the base of the needle tightly onto the nipple of the vacuum manifold as shown in Figure 42.

B9: Repeat steps B3 through B8 for the SO_2 (blue) needle and sample tube.

B10: Turn the pump ON.

B11: Record the vacuum gage reading under "START OPEN" meter reading.

B12: Clamp the hose and record the vacuum gage reading under "Start Meter Reading Clamp".

B13: Turn the pump OFF.

B14: Set the timer to the correct time and date by turning the timer disc in the direction indicated by the arrow until the correct time is under the red line.

B15: Set the sample run date and time trippers on the timer disc. The ON timer tripper is light colored and should be set for midnight before the sample date and the OFF (dark) tripper should be set for midnight at the end of the proposed sample date.

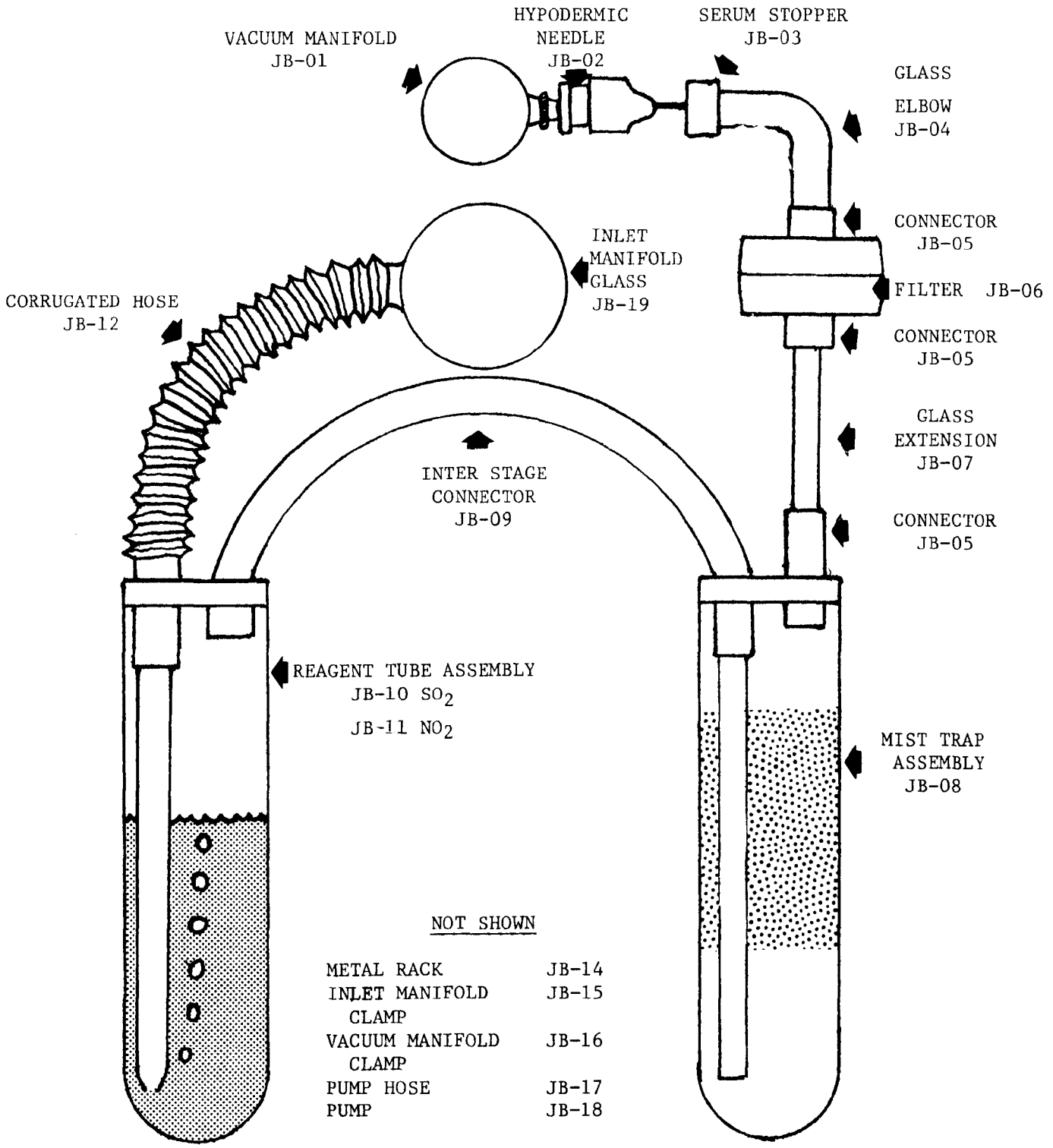


FIGURE 42

Gas Bubbler Parts Identification

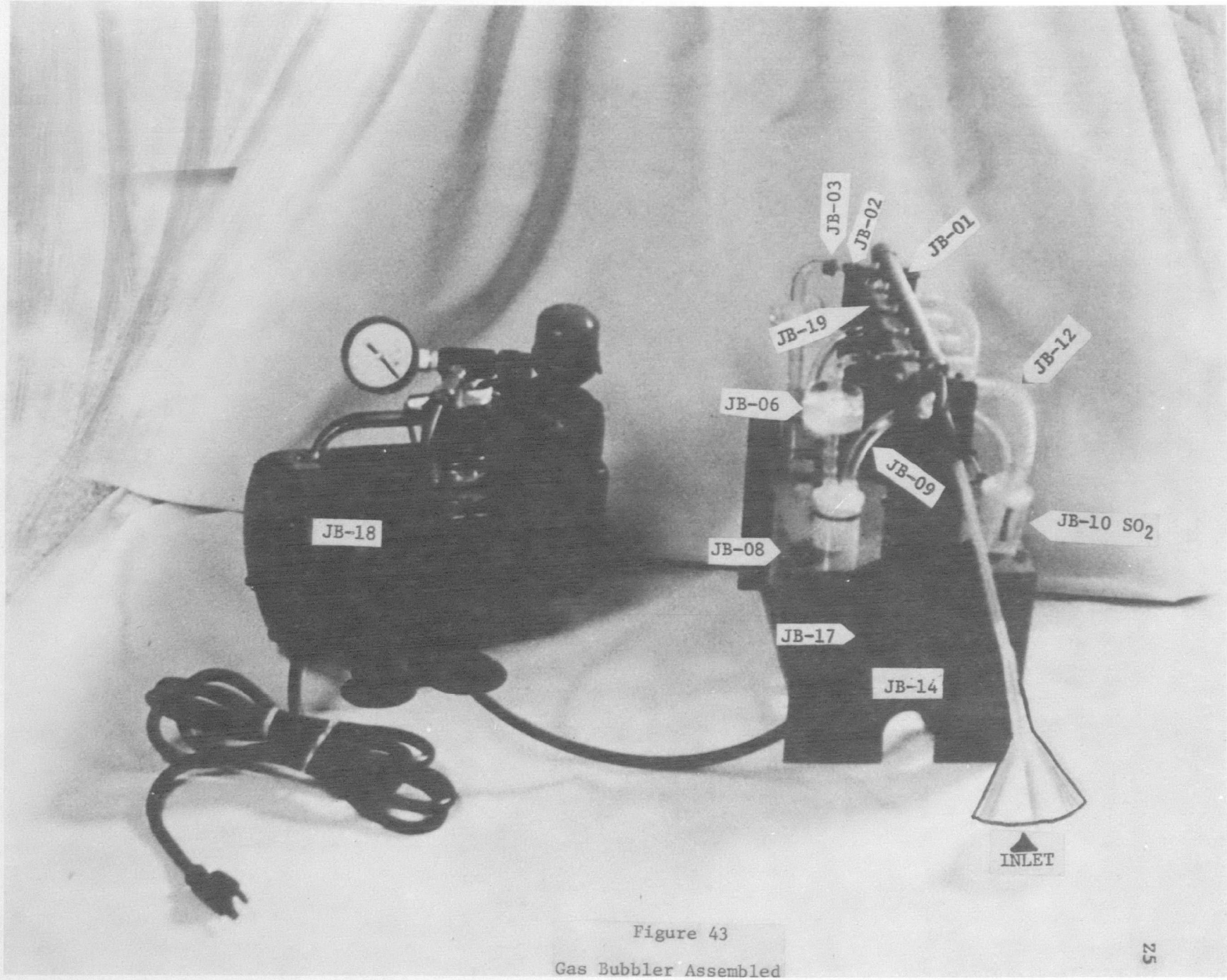


Figure 43

Gas Bubbler Assembled

Authors

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Doyle T. Brittain, Chemist