

- ★ READ THIS INSTRUCTION MANUAL AND THE INSTRUCTIONS OF THE ASPIRATING PUMP PRIOR TO USING THIS PRODUCT.
- ★ DO NOT DISCARD CAREFULLY THIS INSTRUCTION MANUAL UNTIL ALL THE TUBES IN THIS BOX ARE USED UP.

1. PERFORMANCE:

Measuring Range	: 1.25 - 125 ppm	0.5 - 50 ppm
and Pump Stroke	: 1/2 pump stroke	1 pump stroke
(*) Graduations on the detector tube are based on 1 pump stroke		
Sampling Time	: 0.75 minutes	1.5 minutes
Colour Change	: Pale pink → Yellow	
Detectable Limit	: 0.2 ppm	
Operating Temperature	: 0 - 40 °C (32-104°F) (Temperature correction is necessary.)	
Aspirating Pump	: Model AP-20, AP-20S, 400B, AP-1, AP-1S or 400A	

By using printed scale or conversion chart shown at **ITEM 4. CONVERSION CHART**, following gases can be detected.

Gases to be Detected	Measuring Range	Number of pump stroke	Sampling Time
Formic acid	1 - 50 ppm (Printed scale)	1 (100mL)	1.5 minutes
Acrylic acid	1 - 50 ppm (Conversion chart)	1 (100mL)	1.5 minutes
Isovaleric acid	3 - 50 ppm (Conversion chart)	1 (100mL)	1.5 minutes
Isobutyric acid	3 - 50 ppm (Conversion chart)	1 (100mL)	1.5 minutes
n-Valeric acid	3 - 70 ppm (Conversion chart)	1 (100mL)	1.5 minutes
Propionic acid	3 - 50 ppm (Conversion chart)	1 (100mL)	1.5 minutes
Acetic anhydride	1 - 15 ppm (Conversion chart)	1 (100mL)	1.5 minutes
Maleic anhydride	0.2 - 10 ppm (Tube reading × 0.2)	4 (400mL)	6 minutes
Methacrylic acid	1 - 50 ppm (Conversion chart)	1 (100mL)	1.5 minutes
n-Butyric acid	3 - 60 ppm (Conversion chart)	1 (100mL)	1.5 minutes
Operating Temperature	Formic acid : 0 - 40 °C (32 - 104°F) (Temperature correction is necessary.) Other gases : 15 - 25 °C (59 - 77°F) (No temperature correction is necessary.) (Incorrect readings may be given in other temperature range of above-mentioned.)		

▲ CAUTION

1. THE DETECTOR TUBE CONTAINS CHEMICAL REAGENTS.
2. DO NOT TOUCH THESE REAGENTS DIRECTLY ONCE TUBES WERE BROKEN.
3. KEEP THE TUBES OUT OF THE REACH OF CHILDREN.

NOTICE

1. USE ONLY WITH PUMP MODELS AP-20, AP-20S, 400B, AP-1, AP-1S OR 400A. OTHERWISE, CONSIDERABLE ERROR IN INDICATION MAY OCCUR.
2. BEFORE TESTING, CHECK THE ASPIRATING PUMP FOR LEAKS. (REFER TO ITEM 9. INSPECTION OF ASPIRATING PUMP.) ANY PUMPS SHOWING SIGNS OF LEAKAGE SHOULD BE CORRECTED BEFORE USE.
3. DO NOT USE THIS TUBE OUTSIDE THE STATED OPERATING TEMPERATURE RANGE.
4. STORE TUBES IN A COOL AND DARK PLACE (0-25 °C/32-77°F), AND USE BEFORE EXPIRATION DATE PRINTED ON THE TOP OF THE BOX.
5. PRIOR TO USE, READ ITEM 10. USER RESPONSIBILITY CAREFULLY.
6. READ THE CONCENTRATION IMMEDIATELY AFTER DRAWING THE SAMPLE.

2. SAMPLING AND MEASUREMENT:

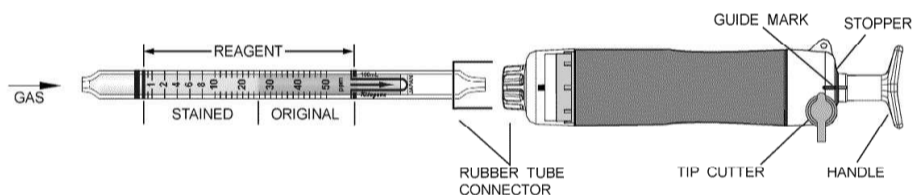


Fig.1

- ① Break both ends of the detector tube.

▲ CAUTION SAFETY GLASSES AND GLOVES SHOULD BE WORN TO PREVENT INJURY FROM SPLINTERING GLASS.

- ② Insert the detector tube into the aspirating pump securely as shown in Fig.1. (Arrow mark shall point to the pump.)
- ③ Align the guide marks on the handle and stopper of the aspirating pump.
- ④ Pull the pump handle at a full stroke until it locks and wait for 1.5 minutes or until the completion of sampling is confirmed with the flow indicator of the pump. (See descriptions about the flow indicator in the instruction manual of the pump.)
- ⑤ On completion of sampling, read the scale at the maximum point of the stained layer.
- ⑥ When the concentration is over the scale range, a 1/2 pump stroke can be used to determine concentrations of 1.25 - 125 ppm
 - 1) Remove the detector tube from the pump.
 - 2) Turn the pump handle right or left by 1/4 (90°), push it toward to the pump.
 - 3) Insert the new tube into the aspirating pump.
 - 4) Pull the pump handle at a 1/2 stroke until it locks and wait for 0.75 minutes or until the completion of sampling is confirmed with the flow indicator of the pump.
 - 5) On completion of sampling, read the scale at the maximum point of the stained layer.
 - 6) Then multiply the reading value by 2.5.
- ⑦ In the case of **Maleic anhydride** measurement, turn the handle right or left by 1/4 (90°), push it toward the pump without removing the detector tube from the pump and repeat step ③~④ three times more. The following equation is available for true concentration.

$$\text{True concentration} = \text{Temperature corrected concentration} \times 0.2$$

SPECIAL NOTE: I. The scale is calibrated at 20 °C (68°F), 50%R.H. and 1013hPa. Readings obtained in other circumstances should be corrected. (REFER TO ITEM 3. CORRECTION FOR AMBIENT CONDITIONS.)
 II. When the maximum point of the stained layer is unclear or oblique, read the scale at the centre between the longest and shortest points.

3. CORRECTION FOR AMBIENT CONDITIONS:

- ① Temperature; The scale is calibrated based on the temperature of 20 °C (68°F). Readings obtained in other temperature circumstances should be corrected with the following temperature correction table.

Table of the coefficient for temperature correction (based on 20 °C)

Temperature (°C)	0	5	10	15	20	25	30	35	40
Correction Factor	1.24	1.17	1.10	1.05	1.00	0.95	0.90	0.85	0.80

Procedure of temperature correction: Actual readings can be obtained by multiplying the readings of tubes by coefficient for temperature correction shown in the above. Therefore,

$$\text{Acetic acid concentration (ppm)} = \text{Reading value (ppm)} \times \text{Coefficient for temperature correction}$$

In the case of **Formic Acid**, correct the tube reading by following temperature correction table.
No temperature correction is necessary at less than 10 ppm.

Tube Reading (ppm)	Corrected Concentration (ppm)		
	0 °C (32°F)	10 °C (50°F)	20 °C – 40 °C (68°F – 104°F)
50	82	60	50
40	57	45	40
30	36	32	30
20	22	21	20
10	10	10	10

② Humidity; No correction is necessary. Higher humidity change the colour of the whole reagent to pink, but the accuracy of the readings is not affected.

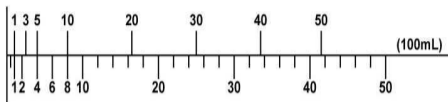
③ Atmospheric Pressure;

$$\text{True concentration} = \frac{\text{Temperature corrected concentration} \times 1013}{\text{Atmospheric pressure (in hPa)}}$$

4. CONVERSION CHART:

Acrylic acid

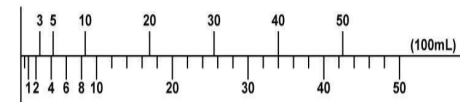
Acrylic acid concentration (ppm)



No.216S tube reading (ppm)

Isovaleric acid

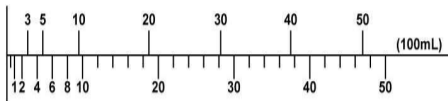
Isovaleric acid concentration (ppm)



No.216S tube reading (ppm)

Isobutyric acid

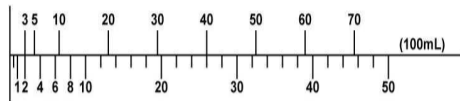
Isobutyric acid concentration (ppm)



No.216S tube reading (ppm)

n-Valeric acid

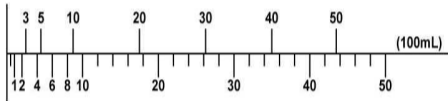
n-Valeric acid concentration (ppm)



No.216S tube reading (ppm)

Propionic acid

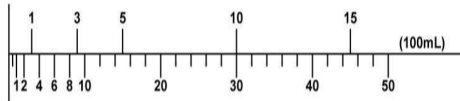
Propionic acid concentration (ppm)



No.216S tube reading (ppm)

Acetic anhydride

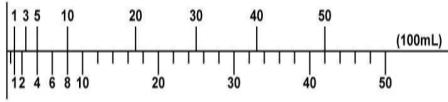
Acetic anhydride concentration (ppm)



No.216S tube reading (ppm)

Methacrylic acid

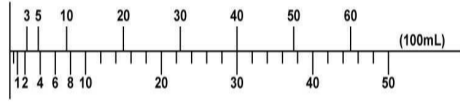
Methacrylic acid concentration (ppm)



No.216S tube reading (ppm)

n-Butyric acid

n-Butyric acid concentration (ppm)

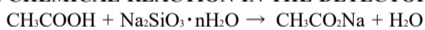


No.216S tube reading (ppm)

5. INTERFERENCE:

Sulphur dioxide produces a similar stain and coexistence of more than 1/20 of Acetic acid concentration gives higher readings. More than 300ppm of Nitrogen dioxide produces a similar stain and coexistence of more than 10ppm produces an unclear stain. Hydrogen chloride produces a pink stain and coexistence of more than double concentration of Acetic acid gives higher readings. Chlorine produces a yellow stain and coexistence of more than 5ppm gives higher readings.

6. CHEMICAL REACTION IN THE DETECTOR TUBE:



7. DISPOSAL OF TUBES:

USED TUBES SHOULD BE DISCARDED CAREFULLY ACCORDING TO RELEVANT REGULATIONS, IF ANY.

8. HAZARDOUS AND DANGEROUS PROPERTIES:

Acetic acid	TLV-TWA ◆: 10ppm	Explosion range in air: 6.0-17%
Formic acid	TLV-TWA ◆: 5ppm	Explosion range in air: 18-51%
Acrylic acid	TLV-TWA ◆: 2ppm	Explosion range in air: 2.4-8%
Isovaleric acid	TLV-TWA ◆: — ppm	Explosion range in air: —
Isobutyric acid	TLV-TWA ◆: — ppm	Explosion range in air: 2-9%
n-Valeric acid	TLV-TWA ◆: — ppm	Explosion range in air: 1.6-7.6%
Propionic acid	TLV-TWA ◆: 10ppm	Explosion range in air: 2.1-12%
Acetic anhydride	TLV-TWA ◆: 1ppm	Explosion range in air: 2.7-10.3%
Maleic anhydride	TLV-TWA ◆: 0.01mg/m ³ (IFV)	Explosion range in air: 1.4-7.1%
Methacrylic acid	TLV-TWA ◆: 20ppm	Explosion range in air: 1.6-8.8%
n-Butyric acid	TLV-TWA ◆: — ppm	Explosion range in air: 2-10%

◆ Threshold Limit Value established by the American Conference of Governmental Industrial Hygienists, 2015.

9. INSPECTION OF ASPIRATING PUMP:

Checking for leaks;

- ① Insert a sealed, unbroken detector tube into the pump.
- ② Align the guide marks on the shaft and stopper of the pump.
- ③ Pull the handle to a full stroke and wait for 1 minute.
- ④ Unlock the handle and allow it to return slowly into the pump by holding the cylinder and handle securely.

⚠ CAUTION HANDLE WILL TEND TO SNAP BACK INTO THE PUMP QUICKLY. ⚠

- ⑤ If the handle returns completely to the original position, the performance is satisfactory.

Otherwise, refer to maintenance procedures shown in the instruction manual of the pump to correct the leakage.

10. USER RESPONSIBILITY:

It is the sole responsibility of the user of this equipment to ensure that the equipment is operated, maintained, and repaired in strict accordance with these instructions and the instructions provided with each Model AP-20, AP-20S, 400B, AP-1, AP-1S or 400A aspirating pump, and that detector tubes are not used beyond their expiration date or have a colour change different to that stated in the Performance specifications.

The Manufacturer and Manufacturer's Distributor shall not be otherwise liable for any incorrect measurement or any damages, whether damages result from negligence or otherwise.

※ Product specifications are subject to change without any prior notice.