

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

1. PERFORMANCE:

Measuring Range	: 0.7 - 14.0 ppm	0.1 - 2.0 ppm (*)
and Sampling Time	: 2 minutes	8 minutes
(*) Graduations on the detector tube are based on 4 pump strokes.		
Number of pump strokes	: 1 (100mL)	4 (400mL)
Colour Change	: Yellow → Pale pink	
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	

▲ CAUTION

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

NOTICE

1. USE ONLY PUMP MODELS AP-20, AP-20S, 400B, AP-1, AP-1S OR 400A. OTHERWISE, CONSIDERABLE ERROR IN INDICATION WILL OCCUR.
2. BEFORE TESTING, CHECK THE ASPIRATING PUMP FOR LEAKS (REFER TO ITEM 8. INSPECTION OF ASPIRATING PUMP). ANY PUMPS SHOWING SIGNS OF LEAKAGE SHOULD BE CORRECTED BEFORE USE.
3. DO NOT USE THIS TUBE BEYOND THE STATED OPERATING TEMPERATURE RANGE.
4. STORE TUBES IN A DARK AND REFRIGERATED PLACE NOT TO EXCEED 10 °C (50°F), AND USE BEFORE EXPIRATION DATE PRINTED ON TOP OF THE BOX.
5. PRIOR TO USE, READ CAREFULLY ITEM 9. USER RESPONSIBILITY.
6. READ THE CONCENTRATION IMMEDIATELY AFTER MEASUREMENT.

2. SAMPLING AND MEASUREMENT:

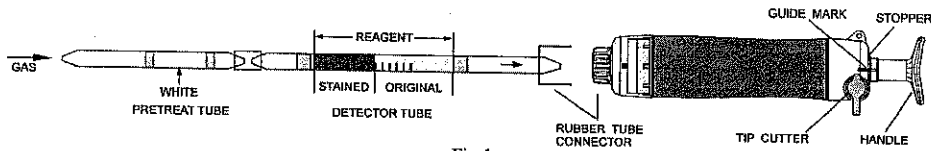


Fig.1

- ① Break both ends of detector tube and pretreat tube, and connect each end of the detector tube and pretreat tube with rubber tube connector as shown in Fig.1.
- ▲ CAUTION SAFETY GLASSES AND GLOVES SHOULD BE WORN TO PREVENT INJURY FROM SPLINTERING GLASS.**
- ② Insert the detector tube (with connecting the pre-treat tube) into aspirating pump securely as shown in Fig.1. (Arrow mark shall point to the pump.)
 - ③ Align the guide marks on the shaft and stopper of the aspirating pump.
 - ④ Pull the pump handle at full stroke until it locks and wait for 2 minutes or until the completion of sampling is confirmed with the flow indicator of the pump (See descriptions about the flow indicator in the instructions of the pump).
 - ⑤ Without removing the detector tube (with connecting the pretreat tube) from the pump inlet, push the pump handle, and air in the pump will be discharged perfectly.
 - ⑥ Then, repeat the above step ④ and ⑤ another three times (four times in total).
 - ⑦ On completion of sampling, read the scale at the maximum point of the stained layer.
 - ⑧ If the discoloration is over the scale, 1 pump stroke (100mL sampling) is available for higher concentrations. Carry out newly from the above ① to ④ once. On completion of sampling, read the at the maximum point of the stained layer. In case of the 1 pump stroke (100mL sampling), the readings should be corrected in accordance with the undermentioned "3. CORRECTION FOR AMBIENT CONDITIONS, (100mL sampling temperature correction table)".

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 obliquely, read the scale at the centre between the longest and shortest points.

3. CORRECTION FOR AMBIENT CONDITIONS:

(In case of 4 pump strokes; 400mL sampling)

- 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 (20 °C standard)

Temp(°C)	0	1	2	3	4	5	6	7	8	9
0	2.21	2.13	2.05	1.98	1.91	1.84	1.77	1.70	1.64	1.58
10	1.51	1.45	1.40	1.34	1.29	1.24	1.19	1.14	1.09	1.05
20	1.00	0.96	0.92	0.88	0.85	0.82	0.78	0.75	0.72	0.70
30	0.67	0.65	0.63	0.61	0.59	0.57	0.56	0.55	0.54	0.53
40	0.52	—	—	—	—	—	—	—	—	—

Procedure of temperature correction:

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

$$\text{Actual Ethylene oxide concentration (ppm)} =$$

$$\text{Reading value (ppm)} \times \text{Coefficient for temperature correction}$$

Procedure to get coefficient for temperature correction from the table:

For example, in case of temperature of 23 °C, the arrow pointed 0.88 which is found by proportional allotment of 20 °C and 3 °C in the table is the coefficient for temperature correction.

Table of the coefficient for temperature correction

Temp(°C)	0	1	2	3	4	5
0	2.21	2.13	2.05	1.98	1.91	1.84
10	1.51	1.45	1.40	1.34	1.29	1.24
20	1.00	0.96	0.92	0.88	0.85	0.82
30	0.67	0.65	0.63	0.61	0.59	0.57
40	0.52	—	—	—	—	—

- ② Humidity; No correction is necessary.

- ③ Atmospheric Pressure;

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

(In case of 1 pump stroke; 100mL sampling)

Correct the tube readings with the following temperature correction table.

Temperature correction table

Readings (ppm)	Temperature (°C)									
	0	5	10	15	20	25	30	35	40	
2.0	—	—	—	—	14.0	10.4	9.2	8.8	8.6	
1.8	—	—	—	—	12.6	9.4	8.3	7.9	7.7	
1.6	—	—	—	—	11.2	8.3	7.4	7.0	6.9	
1.4	—	—	—	—	15.4	9.8	7.3	6.4	6.2	
1.2	—	—	—	—	13.2	8.4	6.2	5.5	5.3	
1.0	—	—	—	—	11.0	7.0	5.2	4.6	4.4	
0.8	—	—	—	—	16.0	8.8	5.6	4.2	3.7	
0.6	—	21.0	12.0	6.6	4.2	3.1	2.8	2.6	2.6	
0.4	22.0	14.0	8.0	4.4	2.8	2.1	1.8	1.8	1.7	
0.2	11.0	7.0	4.0	2.2	1.4	1.0	0.9	0.9	0.9	
0.1	5.5	3.5	2.0	1.1	0.7	0.5	0.5	0.4	0.4	

4. INTERFERENCE:

More than 0.5 ppm of Formaldehyde will give higher reading.

5. CHEMICAL REACTION IN THE DETECTOR TUBE:

Formaldehyde generated through the pretreat tube is detected.

6. DISPOSAL OF TUBE:

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

7. HAZARDOUS AND DANGEROUS PROPERTIES OF ETHYLENE OXIDE:

TLV-TWA. ◆ : 1 ppm

Explosive range in air : 3.0 - 100 %

◆ Threshold Limit Value established by the American Conference of Governmental Industrial Hygienists, 2004.

8. INSPECTION OF ASPIRATING PUMP:

Checking for leaks;

- ① Insert 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 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 procedure in the pump instructions to correct the fault.

9. 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 which are either 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.