KITAGAWA
KOMYO RIKAGAKU KOGYO

INSTRUCTION MANUAL
ETHYLENE OXIDE DETECTOR TUBE

No.122SD

★ 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 and Pump Stroke	: 0.7 - 14.0 ppm : 1 pump stroke	0.1 - 2.0 ppm(*) 4 pump strokes
	(*) Graduations on the detector tube are based on 4 pump strokes.	
Sampling Time	: 2 minutes	8 minutes
Colour Change	: Yellow(**) → Pale pink (**) Occasionally, the original colour of the unused tubes is reddish. But the accuracy of the readings is not affected.	
Operating temperature	: 0 - 40 ℃ (32-104°F) (Temperature correction is necessary)	
Operating humidity	: 10 - 90 %RH (No correction is necessary)	
Aspirating Pump	: Model AP-20, AP-20S, 400B, AP-1, AP-1S, or 400A	

⚠CAUTION
1. THE DETECTOR TUBE AND PRETREAT TUBE CONTAIN 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 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 OUTSIDE THE STATED OPERATING TEMPERATURE RANGE.
4. STORE TUBES IN A REFRIGERATED PLACE (0-10 ℃/32-50°F), AND USE BEFORE EXPIRATION DATE PRINTED ON THE TOP OF THE BOX.
5. PRIOR TO USE, READ **ITEM 9. USER RESPONSIBILITY** CAREFULLY.
6. READ THE CONCENTRATION IMMEDIATELY AFTER DRAWING THE SAMPLE.

2. SAMPLING AND MEASUREMENT:

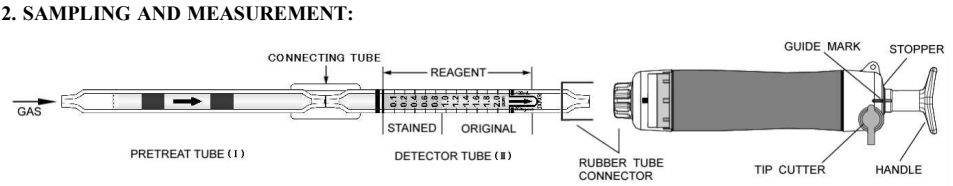

Fig.1

① Break both ends of the pretreat tube (Ⅰ) and detector tube (Ⅱ), and connect each end of the pretreat tube and detector tube with connecting 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 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 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 manual of the pump.)
⑤ Turn the pump handle right or left by 1/4 (90°), push it toward the pump without removing the detector tube from the pump and repeat the step ③ to ④ three times more.
⑥ On completion of sampling, read the scale at the maximum point of the stained layer.
⑦ When the concentrations are over the scale range, 1 pump stroke can be used to determine concentrations of 0.7 to 14.0. After the above ① to ④ and completion of sampling, read the scale at the maximum point of the stained layer and correct the reading value by using correction table for 1 pump stroke. (**REFER TO ITEM 3. CORRECTION FOR AMBIENT CONDITIONS.**)

SPECIAL NOTE: Ⅰ. The scale is calibrated at 20 ℃ (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.
Ⅲ. After breaking the end of detector tubes, forward to the next step as soon as possible. If the detector tubes are left as they are after breaking the end of the detector tubes, the original colour of reagent will be changed to pale yellow by moisture in the air. However, even if the colour change occurs, the accuracy of the readings will not be affected.

3. CORRECTION FOR AMBIENT CONDITIONS:

(In case of 4 pump strokes)

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

Coefficient table of the temperature correction **for 4 pump strokes**

Temperature (℃)	**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,
Actual Ethylene oxide concentration (ppm) =
Reading value (ppm) x Coefficient for temperature correction

Procedure to get coefficient for temperature correction from the table:
For example, in case of temperature of 23 ℃, the arrow pointed 0.88 which is found by proportional allotment of 20 ℃ and 3 ℃ in the table is the coefficient for temperature correction.

Table of the coefficient for temperature correction

Temperature (℃)	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;

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

(In case of 1 pump stroke)

① The scale is calibrated based on 4 pump strokes. Correct the tube readings with the following correction table for 1 pump stroke. The correction table for 1 pump stroke contains temperature correction.

Correction table for **1 pump stroke**

Tube Readings (ppm)	Temperature								
	0 ℃ (32°F)	5 ℃ (41°F)	10 ℃ (50°F)	15 ℃ (59°F)	20 ℃ (68°F)	25 ℃ (77°F)	30 ℃ (86°F)	35 ℃ (95°F)	40 ℃ (104°F)
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	6.0
1.2	—	—	—	13.2	8.4	6.2	5.5	5.3	5.2
1.0	—	—	—	11.0	7.0	5.2	4.6	4.4	4.3
0.8	—	—	16.0	8.8	5.6	4.2	3.7	3.5	3.4
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

Procedure of correction:
Actual reading can be obtained from the correction table.
For example, in case of tube reading is 1.6 ppm at 25 ℃ (77°F), 8.3 ppm is the actual Ethylene oxide concentration.

Correction Table for **1 pump stroke**

Tube Readings (ppm)	Temperature								
	0 ℃ (32°F)	5 ℃ (41°F)	10 ℃ (50°F)	15 ℃ (59°F)	20 ℃ (68°F)	25 ℃ (77°F)	30 ℃ (86°F)	35 ℃ (95°F)	40 ℃ (104°F)
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	6.0

② Humidity; No correction is necessary.
③ Atmospheric Pressure;

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

4. INTERFERENCE:
More than 0.5 ppm of Formaldehyde gives higher readings.

5. CHEMICAL REACTION IN THE DETECTOR TUBE:
Formaldehyde generated through the pretreat tube is detected.

6. DISPOSAL OF TUBES:
USED TUBES SHOULD BE DISPOSED CAREFULLY ACCORDING TO RELEVANT REGULATIONS, IF ANY.

7. HAZARDOUS AND DANGEROUS PROPERTIES OF ETHYLENE OXIDE:
TLV-TWA ◆ : 1 ppm
Explosion range in air : 3.0 - 100 %
◆ Threshold Limit Value established by the American Conference of Governmental Industrial Hygienists, 2012.

8. 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.

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 beyond their expiration date or have a colour change different to that stated in the Performance specifications.
The Manufacturer and Manufacturer's Distributors 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.

IME1223/2

Printed in Japan