KITAGAWA
KOMYO RIKAGAKU KOGYO

INSTRUCTION MANUAL
HYDROGEN CYANIDE DETECTOR TUBE

No.112SB

★ 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.

1. PERFORMANCE:

Measuring Range and Sampling Time	: 2 - 100 ppm (*) : 1 minute	0.5 - 25 ppm 4 minutes	4.6 - 230 ppm 30 seconds
(*) Graduations on the detector tube are based on 1 pump stroke.			
Number of Pump Stroke	: 1 (100mL)	4 (400mL)	1/2 (50mL)
Colour Change	: Yellow → Red		
Detectable Limit	: 0.2 ppm (4 pump strokes)		
Operating Temperature:	: 0 - 40 ℃ (32-104°F) No temperature correction is necessary for 1 pump stroke or 4 pump strokes. Temperature correction is necessary for 1/2 pump stroke.		
Operating Humidity:	: 10 - 90%R.H. Humidity correction is necessary for 1 pump stroke or 4 pump strokes. No Humidity correction is necessary for 1/2 pump stroke.		
Aspirating Pump	: Model AP-20, AP-20S, AP-1 or AP-1S		

⚠CAUTION
1. THE DETECTOR TUBE CONTAINS CHEMICAL 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, AP-1 OR AP-1S. OTHERWISE, CONSIDERABLE ERROR IN INDICATION MAY 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 REFRIGERATED PLACE (0-10 ℃/32-50°F), AND USE BEFORE EXPIRATION DATE PRINTED ON THE 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:

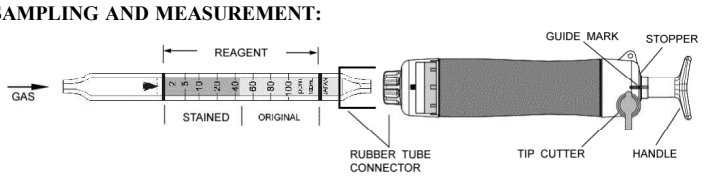

Fig.1

① Break both ends of 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 shaft and stopper of the aspirating pump.
④ Pull the pump handle at a full stroke until it locks and wait for 1 minute 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 below the scale range, 4 pump strokes can be used to determine concentrations of 0.5 - 25 ppm. Repeat the procedures ③ to ⑤ 3 times more, then following equation is available for true concentration after correcting humidity using undermentioned table. (**REFER TO ITEM 3. CORRECTION FOR AMBIENT CONDITIONS.**)

True concentration = Humidity corrected concentration × 0.25

⑦ If the discolouration is over the full scale (100 ppm), a 1/2 (50mL) pump stroke sampling is available. Insert the new detector tube into the pump inlet and pull the pump handle at a 1/2 pump stroke (to 50mL line), and it will be automatically locked. Leave it for 30 seconds as it is.
⑧ Remove the detector tube from the pump and read the scale at the maximum point of the stained layer.
⑨ Read the scale at the maximum point of the stained layer and correct the reading value by using correction table for 1/2 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 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:

(In case of 1 pump stroke or 4 pump strokes)
Temperature; No correction is necessary.
Humidity; Correct the tube reading by following Humidity correction table.

Humidity Correction Table					
Tube Readings (ppm)	Corrected Concentration (ppm)				
	10%R.H.	30%R.H.	50%R.H.	70%R.H.	90%R.H.
100	91.0	95.0	100.0	105.0	111.0
80	73.0	76.0	80.0	84.0	88.5
60	54.5	57.0	60.0	63.0	66.0
40	36.0	38.0	40.0	42.0	44.5
20	18.0	19.0	20.0	21.0	22.5
10	8.4	9.2	10.0	10.8	11.6
5	4.2	4.6	5.0	5.4	5.8
2	2.0	2.0	2.0	2.0	2.0

Note: Humidity correction procedure
Example 1: When the tube reading is 60 ppm at 30%R.H., the concentration is 57 ppm.

Humidity Correction Table					
Tube Readings (ppm)	Corrected Concentration (ppm)				
	10%R.H.	30%R.H.	50%R.H.	70%R.H.	90%R.H.
100	91.0	95.0	100.0	105.0	111.0
80	73.0	76.0	80.0	84.0	88.5
60	54.5	57.0	60.0	63.0	66.0
40	36.0	38.0	40.0	42.0	44.5
20	18.0	19.0	20.0	21.0	22.5
10	8.4	9.2	10.0	10.8	11.6
5	4.2	4.6	5.0	5.4	5.8
2	2.0	2.0	2.0	2.0	2.0

Example 2: When the tube reading is 30 ppm at 20%R.H., the true concentration is 27.8 ppm which is found by proportional allotment of each concentration and humidity as shown below.

Humidity Correction Table					
Tube Readings (ppm)	Corrected Concentration (ppm)				
	10%R.H.	30%R.H.	50%R.H.	70%R.H.	90%R.H.
100	91.0	95.0	100.0	105.0	111.0
80	73.0	76.0	80.0	84.0	88.5
60	54.5	57.0	60.0	63.0	66.0
40	36.0	38.0	40.0	42.0	44.5
20	18.0	19.0	20.0	21.0	22.5
10	8.4	9.2	10.0	10.8	11.6
5	4.2	4.6	5.0	5.4	5.8
2	2.0	2.0	2.0	2.0	2.0

(ppm)	10%R.H.	20%R.H.	30%R.H.
40	36.0	(37.0)	38.0
(30)	(27.0)	(27.8)	(28.5)
20	18.0	(18.5)	19.0

Numerals in parentheses are determined by proportional allotment.

(In case of 1/2 pump stroke)

The scale is calibrated based on 1 pump stroke. Correct the tube readings with the following correction table for 1/2 pump stroke. The correction table for 1/2 pump stroke contains temperature correction.
Temperature; Correct the tube reading by following temperature correction table.
Humidity; No correction is necessary.

Correction table for 1/2 pump stroke

Corrected Concentration (ppm)					
Tube Readings (ppm)	0 ℃ (32°F)	5 ℃ (41°F)	10 ℃ (50°F)	15 ℃ (59°F)	20 ～ 40 ℃ (68 ～ 104°F)
100	—	—	—	—	230
80	—	—	220	202	184
60	186	171	156	147	138
40	106	99	92	92	92
20	46	46	46	46	46
10	23	23	23	23	23
5	11.5	11.5	11.5	11.5	11.5
2	4.6	4.6	4.6	4.6	4.6

Atmospheric Pressure;

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

4. INTERFERENCE:

Sulphur dioxide, Phosphine or Hydrogen sulphide produced a similar stain and coexistence of more than 1 ppm, 1 ppm, 3 ppm, respectively with Hydrogen cyanide gives higher readings. Ammonia does not change the reagent by itself but coexistence of more than 5 ppm with Hydrogen cyanide gives lower readings.

5. CHEMICAL REACTION IN THE DETECTOR TUBE:

$HCN + HgCl_2 \rightarrow HCl$

6. DISPOSAL OF TUBES:

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

7. HAZARDOUS AND DANGEROUS PROPERTIES OF HYDROGEN CYANIDE:

TLV-STEL ◆ : 4.7 ppm (Ceiling)
Explosion range in air : 5.6 - 40%

◆ Threshold Limit Value established by the American Conference of Governmental Industrial Hygienists, 2021.

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, AP-1 or AP-1S 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 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.

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