

**Kitagawa SEPARATED OXYGEN AND CARBON DETECTOR TUBES**

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

**1. PERFORMANCE:**

Measuring Range	Oxygen : 2 - 10 %
	Carbon dioxide : 1 - 20 %
and Sampling Time:	8 minutes
Colour Change:	Oxygen White → Brown
	Carbon dioxide Pink → Yellow
Operating temperature:	10 - 40 °C (50-104°F) ( No corrections are necessary.)
Aspirating Pump:	Model AP-1, AP-1S, 400A or AP-400

**•CAUTION**

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

**NOTICE**

1. USE ONLY WITH PUMP MODELS AP-1, AP-1S, 400A OR AP-400. OTHERWISE, CONSIDERABLE ERROR IN INDICATION MAY OCCUR.
2. DON'T USE FLOW CONTROL ORIFICE WITH THIS TUBE. (FOR MORE DETAIL, REFER TO THE INSTRUCTIONS OF THE ASPIRATING PUMP.)
3. BEFORE TESTING, CHECK THE ASPIRATING PUMP FOR LEAKS (REF. ITEM 5). ANY PUMPS SHOWING SIGNS OF LEAKAGE SHOULD BE CORRECTED BEFORE USE.
4. DON'T USE THIS TUBE OUTSIDE THE STATED OPERATING TEMPERATURE RANGE.
5. STORE TUBES IN A COOL AND DARK PLACE (0-25 °C/32-77°F), AND USE BEFORE EXPIRATION DATE PRINTED ON TOP OF THE BOX.
6. PRIOR TO USE, READ CAREFULLY ITEM 6 "USER RESPONSIBILITY" .

**2. SAMPLING AND MEASUREMENT:**

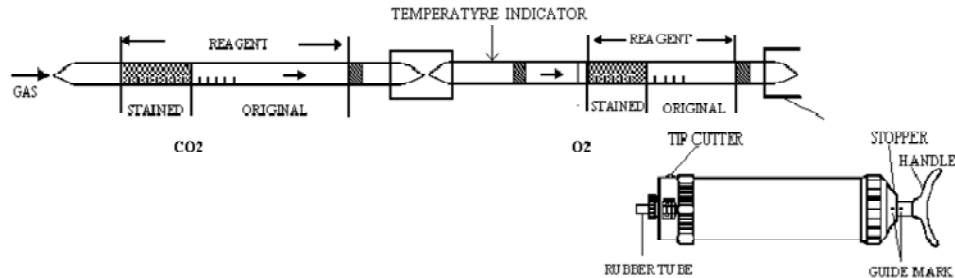


Fig.1

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

- ① Break both ends of Carbon dioxide detector tube by using the tip cutter and insert the rubber tube into the detector tube end according to the direction of printed arrow mark in Fig.1. (Arrow mark shall point to the pump.)
- ② Heat the temperature indicator of the Oxygen detector tube with a match or cigarette lighter until the indicator is changed to blackish purple from red.
- ③ Break both ends of oxygen detector tube using tip cutter immediately, connect the colour indicator side of the oxygen detector tube with the carbon dioxide detector tube and insert the oxygen detector tube into the rubber tube connector.
- ④ Align the guide marks (red dots) on the piston rod and stopper of the aspirating pump. Pull the pump handle at full stroke until it locks and wait for 8 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).  
**NOTE:** If using Model AP-400, pull pump handle to full stroke and turn the handle by 1/4 (90°), then wait for 8 minutes.
- ⑤ On completion of sampling, read the scale at the maximum point of the stained layer.
- ⑥ Temperature correction:  
 In the range of 10-40 °C, no temperature correction is necessary for the Carbon dioxide detector tube.

Readings of the Oxygen detector tube should be corrected with the temperature correction table.  
**SPECIAL NOTE:** I . The scale is calibrated at 20 °C (68°F) and 1013hPa. Readings obtained in other circumstances should be corrected (REF. ITEM 3).  
 II . When the maximum point of the stained layer is unclear, read the scale at the centre between the longest and shortest points.

Temperature Correction Table for Oxygen Detector Tube (Calibrated at 20 °C)

Tube Readings (%)	Temperature Correction Table			
	Corrected Concentration (%)			
	10 °C (50°F)	20 °C (68°F)	30 °C (86°F)	40 °C (104°F)
10.0	9.7	10.0	10.3	10.5
9.0	8.7	9.0	9.3	9.5
8.0	7.7	8.0	8.3	8.5
7.0	6.7	7.0	7.3	7.5
6.0	5.7	6.0	6.3	6.5
5.0	4.7	5.0	5.3	5.5
4.0	3.9	4.0	4.2	4.5
3.0	2.9	3.0	3.1	3.3
2.0	2.0	2.0	2.0	2.1

**3. CONCENTRATION CORRECTION:**

On account of interaction of indication between carbon dioxide and oxygen, the true concentration is calculated by the following equations.

$$CO_2\% = (CO_2) - \frac{(O_2) \times (CO_2)}{100} \text{ -----equation (1)}$$

$$O_2\% = (O_2) - \frac{(CO_2) \times (O_2)}{100} \text{ -----equation (2)}$$

where (CO<sub>2</sub>) : indication of carbon (%)  
 (O<sub>2</sub>) : corrected oxygen concentration (%)

**[EXAMPLE]**

At the measuring temperature of 30 °C, when carbon dioxide indication is 5% (temperature corrected value 5.3%), each true concentration is calculated as bellow.

$$CO_2\% = 10 - \frac{5.3 \times 10}{100} = 10 - 0.53 = 9.47$$

$$O_2\% = 5.3 - \frac{5.3 \times 10}{100} = 5.3 - 0.53 = 4.77$$

Accordingly true concentration ; Carbon dioxide 9.47 %  
 Oxygen 4.77 %

**4. INFLUENCE BY OTHER GASES:**

Ordinary combustion gases do not affect the reading value and discolouration.

**[NOTE]**

Carbon dioxide detector tube can be used independently. In this case, correction in relation tube can not be used independently.

Threshold Limit Value: Carbon dioxide 5000ppm (Japan), (U.S.A) 2000

**5. 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 3 minutes. (If using Model AP-400, turn the handle by 1/4 (90°) to lock it.)
- 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.

**6. 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-1, AP-1S, 400A or AP-400 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.