
INSTRUCTION MANUAL

TUBE WARMING SYSTEM

MODEL TWS-201

NEVER FAIL TO READ THIS INSTRUCTION MANUAL FOR CORRECT USE

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Foreword

MODEL TWS-201 TUBE WARMING SYSTEM is designed for sampling gases under the circumstances of the low temperature (at least down to -20 degrees Centigrade). As the inside of a bag of MODEL TWS-201 TUBE WARMING SYSTEM is heated with associated heat packs, it can secure the operating temperature for gas detector tubes (ordinary 0-40 degrees Centigrade) under the circumstances of the low temperature. Therefore, the system allows sampling gases at the same accuracy as ordinary sampling with any of gas detector tubes unless you make a measurement accurately after keeping the temperature inside the bag to the operating temperature of gas detector tubes.

Composition



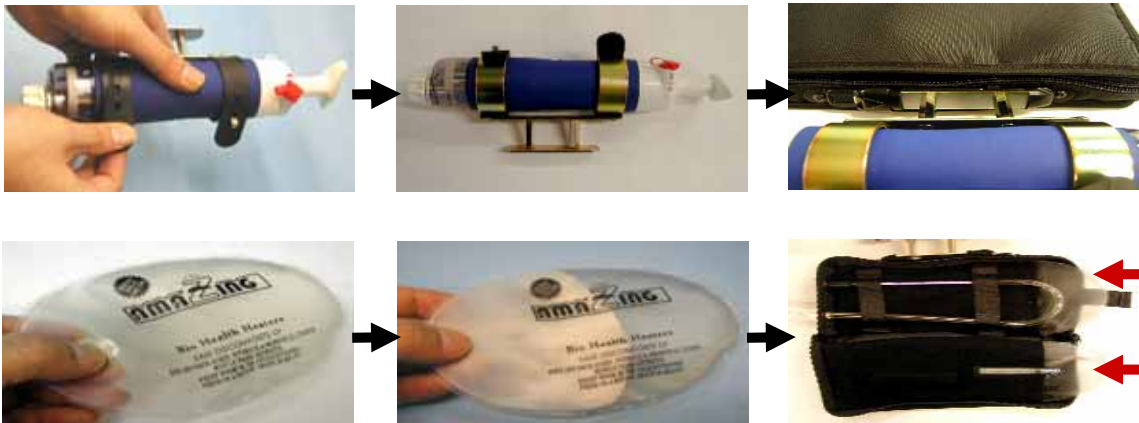
Bag
Hot pack (× 2)
Holder for Model AP-20

Tubing for Model AP-20 aspirating pump
Tubing for gas detector tube
(used for pre-treat tube)
Thermometer

1. Measuring procedure

2. 1 Preparation

- 1) Combine a holder for Model AP-20 Aspirating Pump and Model AP-20 Aspirating Pump (refer to &).
- 2) Combine the holder and the bag (refer to).
- 3) Insert a thermometer into a pocket of the bag as shown in the picture .
- 4) To adjust the temperature inside the bag to the operating temperature of gas detector tubes, heat the hot packs and leave them until their temperature decrease below 40 degrees Centigrade beforehand. (Check the temperature with the thermometer).
- 5) Place 2 pieces of the hot packs into pockets in both side of the bag (refer to) after heating (refer to the under-mentioned “How to heat the hot packs ”).



• How to heat the hot packs (refer to &)

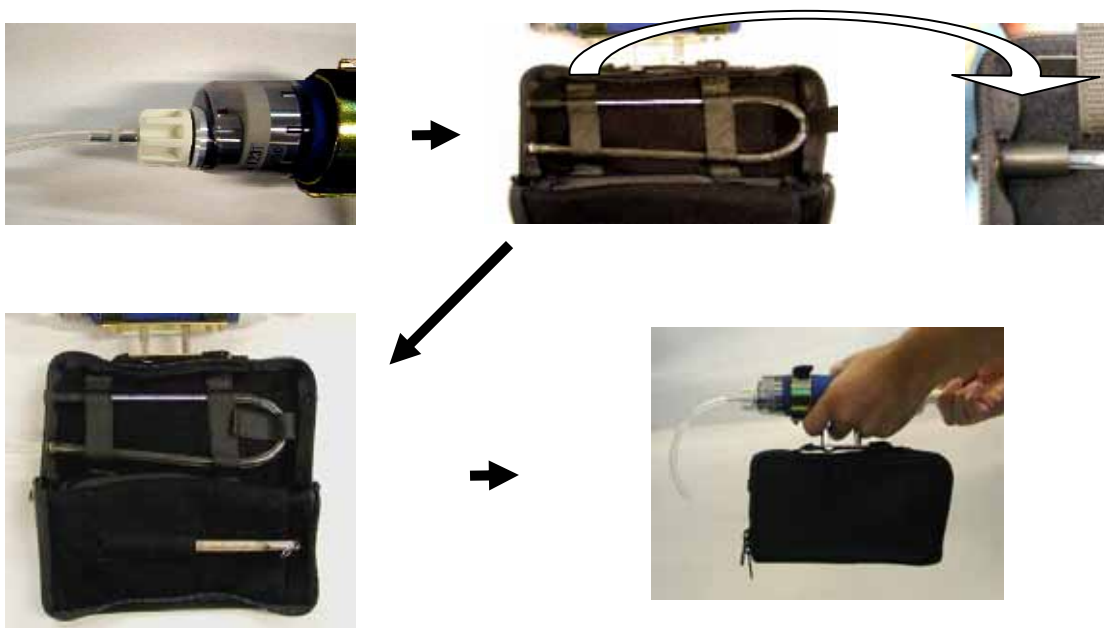
Push the metallic button softly inside the hot packs.

When you see white crystals spread inside them, they start to warm.

If you cannot see any white crystals, push the button over again.

2. 2 Setting and sampling of gas detector tubes

- 1) When the temperature inside the bag decreases below 40 degrees Centigrade, connect the tubing for Model AP-20 Aspirating Pump into a rubber tube connector of the Model AP-20 Aspirating Pump.
- 2) Put another end of the tubing into the bag through a hole. Cut both ends of a gas detector tube and connect the sampling end into the rubber connector in the bag as shown in the picture . (refer an arrow ⇨) Use velcro straps to fix the gas detector tube and the tubing.
In case of sampling with a pre-treat tube (connecting two tubes), refer to the connecting method hereinafter described (refer to **2.0ther precautions**).
- 3) After closing a zipper of the bag, leave it for few minutes in order to stabilize the temperature of the gas detector tube to the temperature of inside the bag and then make a measurement. (Make sure that you hold Model AP-20 when you make a measurement. Refer to the instruction manuals of each gas detector tube systems.)



- 4) Upon completion of the sampling, open the bag promptly and read the scale of the thermometer.
- 5) In case the temperature correction is required, calculate the true concentration by correcting the volume after the temperature correction (refer to the instruction manual for gas detector tubes). In case the

temperature correction is not required, calculate the true concentration by correcting the volume. The volume correction can be obtained with the following calculation.

The true concentration (volume correction) =
temperature correction value or reading value $\times (273 - t1) / (273 + t2)$

t1 : outside air temperature ()

t2 : temperature inside the bag (temperature of the gas detector tube)

- **Note**

In case that the outside air temperature is around -20 , the temperature inside the bag decreases gradually. If you leave it for a while after measurement, you cannot obtain the correct concentration because you cannot read the correct temperature at the time of measurement.

6) Under the circumstances that the air temperature is around -20 degrees Centigrade outside, the temperature inside the bag can be kept the operating temperature of gas detector tubes for one or one and half hours. If you wish to make a measurement continuously, connect the new gas detector tube quickly and make a measurement.

To keep the temperature of the gas detector tube, leave it for few minutes after connecting the gas detector tube and then make a measurement.

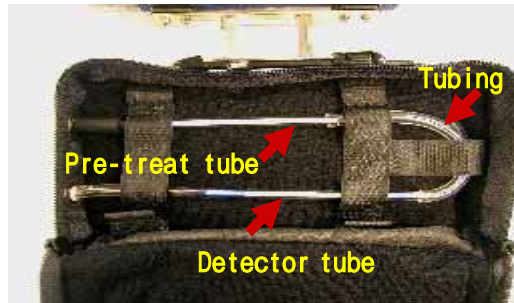
7) Reusing hot packs **(Be careful for scald)**

- Wrap the used hot packs in soft clothes and put them into boiling water.
- Soak the hot packs until the gel inside them becomes soft and clear. (For 15 minutes to 20 minutes)
- Upon the gel inside the hot packs becomes clear, take them out from the water and leave them until their temperature decrease to the room temperature.

2. Other precautions

In case of using pre-treat detector tubes(connecting 2 tubes)

Connect the pre-treat tube into the gas detector tube with a tubing for gas detector tubes and clip the tubing to fit inside the bag as shown in the picture . Refer to 2.2.3) for operation method.



In case of using rubber extension hose(optional)



Fitting of bag
Connector for Model AP-20

Rubber extension hose for the bag (10m)



Remove Model AP-20 Aspirating Pump from the bag.



Remove a connector holder from Model AP-20 Aspirating Pump.



Connect a connector of the rubber extension hose into Model AP-20 Aspirating Pump.



Attach a fitting of the rubber extension hose to the bag.



Connect the sampling end of the gas detector tube into the rubber extension hose.



An image when you use the rubber extension hose.

- **Note**

Treat the rubber extension hose carefully and never treat it violently such as swinging it around.

Bring it down to the measuring point very carefully.