

MOISTURE EXCHANGE TUBES FOR HUMIDITY CONTROL OF TEST GASES

INTRODUCTION

Some gas detection instruments such as photoionization detectors (PIDs) have a reduced response in humid air, compared to the dry air that is often used for calibration. A convenient way to correct for this effect is to humidify the calibration gas to the same humidity as the air to be measured. Humidity corrections are usually negligible for PIDs below 40% RH (relative humidity) at room temperature and for electrochemical sensors, although the latter may have transient responses to humidity changes. The CDRAE has a humidity effect that is compensated automatically by the instrument. Additional correction may be helpful under extreme conditions.

Moisture Exchange Tube

RAE Systems provides a 24" (61cm) Moisture Exchange Tube (p/n 030-3018-000) that can be connected directly between the calibration gas and instrument calibration cup or other connector. The tube consists of a membrane that allows moisture to pass, but retains organic vapors. Thus, moisture from ambient air enters the gas stream inside the tube without losing the organic compound.

The tube works best for low-molecular-weight, nonpolar compounds like propane and isobutylene. Heavier compounds like toluene can be adsorbed onto the tube, and polar compounds such as alcohols, aldehydes, amines, and ketones can be lost by absorption into the moist pores of the tube. In principle, the tube could also be used to dry a humid measurement stream, if the tube is jacketed with a dry air stream or other drying agent such as a silica gel pack.

OPERATION

To operate the tube, first allow it to equilibrate for at least five minutes at the humidity desired for subsequent measurements. Then simply connect it between the calibration gas cylinder and the instrument inlet probe or calibration cup, and calibrate as usual (see Figure 1). The direction of flow through the tube is not important.

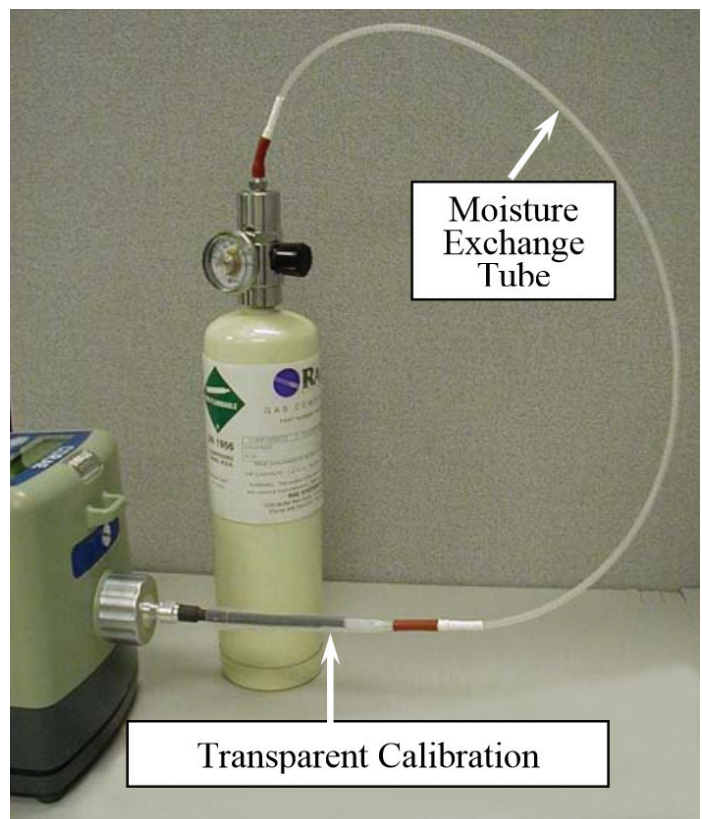


Figure 1. Connection of Moisture Exchange Tube to gas cylinder and open calibration tube.

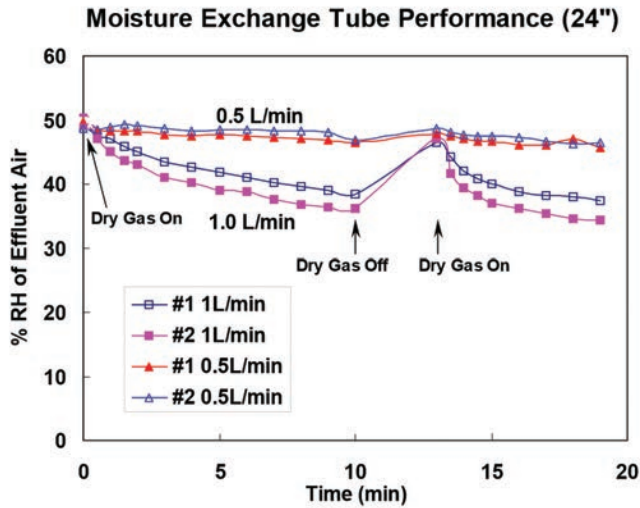


Figure 2. Humidification of dry air using the Moisture Exchange Tube.

Figure 2 shows the humidification efficiency as a function of gas flow rate. At 0.5 L/min., the tube is able to equilibrate a dry gas stream to ambient humidity for an extended period of at least 10 minutes. At 1.0 L/min., it is recommended that the calibration be

completed within two minutes of starting the gas flow in order that the humidity not drop by more than 10% (by <5% RH at 50% RH). Figure 2 shows that when the dry gas is turned off, the tube recovers by absorbing moisture from the ambient air. The tube appears to have a reservoir of moisture in its pores that requires replenishment after being used to humidify a dry gas sample. Therefore, if multiple calibrations are to be performed with a single tube at 1 L/min. or more, at least five minutes humidity equilibration time should be allowed with the gas off between calibrations. The tube is rated for flows up to 2 L/min., but shows reduced performance at this higher flow rate.

OTHER MATRIX GAS EFFECTS

The Moisture Exchange Tube does not compensate for other matrix gas effects, such as the suppression of PID signals due to methane, because methane does not pass through the membrane.