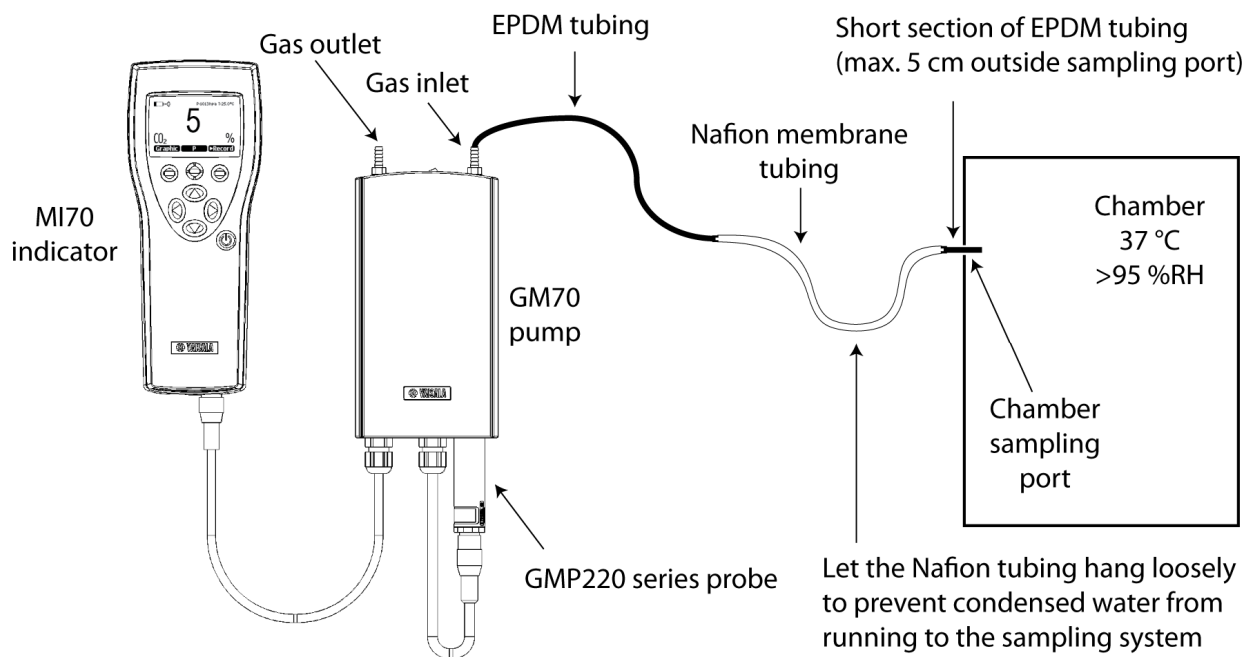


## USING THE NAFION<sup>®</sup> MEMBRANE TUBE WITH THE GM70

The GM70 with pump-aspirated sampling is designed for drawing gas samples from spaces where diffusion-based measurement is not possible like ducts, chambers, tanks, and other confined spaces. The air-tight structure of the GM70 pumping system allows, for example, the circulation of the sample gas.

When performing spot-checking with the GM70, it is very important to protect the GM70 pumping chamber and the NDIR sensor inside the GMP220 series probe from condensation. Condensation may occur when drawing a gas sample from a warm and humid environment such as a climate chamber or an incubator into ambient conditions.

To prevent condensation, it may be necessary to dry the sample gas before it enters the pump unit. The most common approach to dry a gas sample is to cool and re-heat the air. An alternative approach is to use the Nafion<sup>®</sup> membrane tube delivered with the pump-aspirated GM70 (Part No. 212807GM). It is not recommended to use silica gel to remove humidity when making CO<sub>2</sub> measurements, since silica gel inhales also CO<sub>2</sub>.



**Figure 1 Sampling System with Nafion<sup>®</sup> Membrane Tube**

The Nafion<sup>®</sup> tube should be placed near the start of the sampling line (see Figure 1). The rest of the tubing can be EPDM or equivalent. Three meters of EPDM tubing is included with the pump. To prevent mechanical damage to the Nafion<sup>®</sup> tube, do not use it as the first part of the sampling line.

When using the GM70 pump, take the following precautions to prevent condensation from interfering with measurement:

- Keep the first section of tubing short. There should be no more than 5 cm of EPDM tubing outside the chamber before the Nafion<sup>®</sup> tubing.
- Keep the GM70 pump always above the level of the chamber sampling port, also when connecting or disconnecting the tubing.
- When drawing a gas sample from a chamber, a few centimeters of the sampling line should be placed inside the chamber. If there is a risk for condensation inside the chamber where the sample is drawn, take special care that the condensate is not running to the tube.
- To check that condensation has not reached the probe, you can pull out the CO<sub>2</sub> probe from the GM70 pump. When re-inserting the probe, do not push the probe all the way in. Instead, match the two O-rings together with the smooth probe surface to achieve a tight connection.

### Nafion<sup>®</sup> Membrane Tube

Nafion<sup>®</sup> is a co-polymer of tetrafluoroethylene (Teflon) and perfluoro-3,6-dioxa-4-methyl-7-octene-sulfonic acid, which is highly selective in water removal. Water transfers through the membrane wall and evaporates into the surrounding air in a process called *perevaporation*. Drying is complete when sample humidity level is equal to the ambient humidity level. This level can be reached typically in 100–200 milliseconds, which makes the tube ideal for drawing a sample from a very humid environment to room temperature.

The Nafion<sup>®</sup> membrane tube removes water, alcohols, ammonia, amines, and other compounds having a hydroxyl group or potential for forming one under acid catalysis. Some compounds are not removed but are rendered by acid catalysis. Inorganic compounds are not normally removed, except water and ammonia. The CO<sub>2</sub> content of the gas sample is not affected. However, note that water removal from the gas sample results in a higher CO<sub>2</sub> reading due to increased partial pressure of CO<sub>2</sub> in the dried gas.



**Figure 2** Nafion<sup>®</sup> Membrane Tube, part no. 212807GM

More information on the Nafion<sup>®</sup> tube can be obtained from: [www.permapure.com](http://www.permapure.com).