

12-INCH PASSIVE DRYSTIK

Passive Moisture Exchanger Accessory for the RAD8
User Manual



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INTRODUCTION

The 12-inch Passive DurrIDGE Drystik consists of a Nafion™ membrane tube with a purge sheath, and tubing connections for attaching to the RAD8.

Nafion, a material invented by DuPont and marketed by Perma Pure, consists of PTFE (Teflon) laced with hydrophilic molecules that will pass water molecules from one to another down a humidity gradient in the material. If the humidity inside the membrane tube is higher than the humidity in the purge sheath, then water molecules will be transported from inside the tube to the purge sheath. This is purely a chemical process. There are no micro-pores and other gases cannot cross the membrane.

The 12-inch Passive Drystik relies on the RAD8's internal pump to create a suitable degree of pressure and control the sample flow rate. Under the standard operating configuration with the Drystik's inner membrane tube downstream of the RAD8 pump and upstream of the RAD8 measurement chamber, the air inside the membrane tube is compressed, thus increasing the humidity and making the system much more efficient. The desiccant in a Laboratory Drying Unit can be made to last far longer than is possible without a Drystik.

Compressing the incoming air causes water molecules to cross to the purge sheath even if the sheath is filled with fresh air at ambient humidity. Thus, the system will start to dry incoming ambient air even without dry purging air in the sheath. If the dryer outlet air is circulated back to become purge air it will increase the efficiency of the drying process and the system becomes regenerative, bringing the air leaving the membrane tube to progressively lower humidity.

Ideally, the Nafion tube should be purged with dry air flowing at two or three times the sample flow velocity. However, with the incoming air compressed, the device is still effective even when only the dried sample air is used to purge the system. The relative humidity can be brought down significantly even with no desiccant in the air path, but it is more efficient if desiccant is used.

Nafion is an amazing material. It loves water vapor. But its function is inhibited by the presence of liquid water. Compression of ambient air in high-humidity conditions can produce condensation in the membrane tubing, reducing the efficiency of the system. Reducing the duty cycle by setting the RAD8's pump to 'Standard' mode (in which it runs for 2 minutes in every 5) can mitigate the effect of condensation.

1 GETTING STARTED

1.1 Unpacking

First make sure your Drystik package contains everything you are supposed to have. Examine the package contents and verify that you have all the items shown in the packing list. If anything is missing, please contact DurrIDGE immediately.

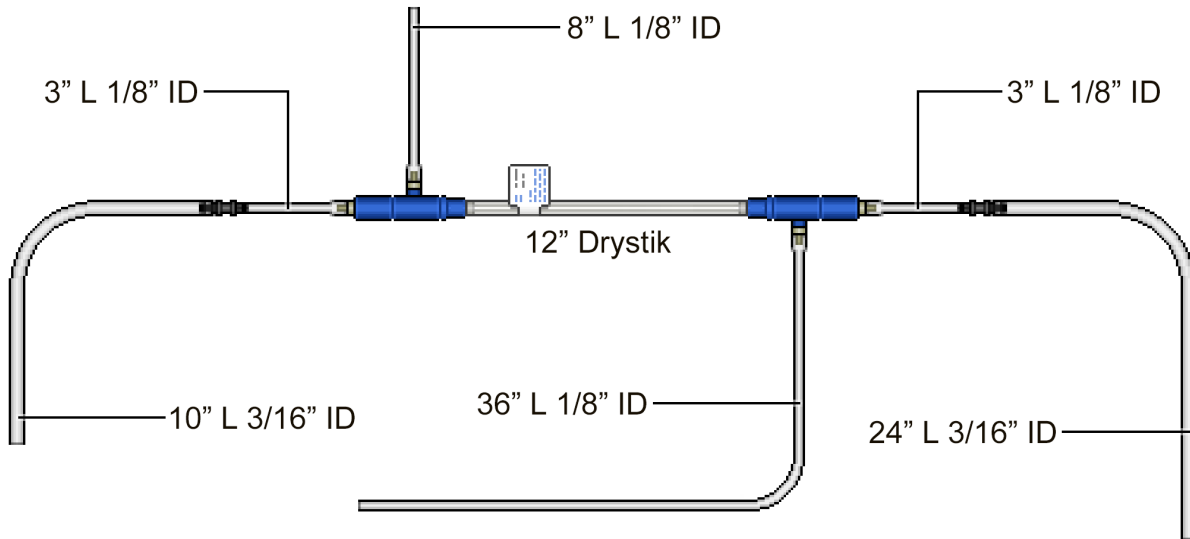


Fig. 1 12-Inch Passive Drystik Diagram

1.2 General Safety Instructions

There is nothing hazardous to the user in the Drystik package. To protect the Drystik, do not let it come in direct contact with water. It is also important to prevent air samples containing liquid water from entering the unit. This is covered in the usage instructions later in this manual.

1.3 Drystik Packing List

The Drystik system consists of the following components:

- The main 12-inch Drystik Nafion tube
- Connected vinyl tubing, consisting of the following sections:
 - 3" long 1/8" inner diameter, to 10" long 1/8" inner diameter
 - 8" long 1/8" inner diameter
 - 3" long 1/8" inner diameter, to 24" long 1/8" inner diameter
 - 36" long 1/8" inner diameter

2 USING THE DRYSTIK

2.1 Connections and Controls

Connect the 12-Inch Passive Drystik to the RAD8 as shown in Figure 2, below. The Laboratory Drying Unit shown in the illustration is suitable when measuring radon. When measuring thoron the Laboratory Drying Unit should be replaced with a Small Drying Tube, as explained in Section 2.3.

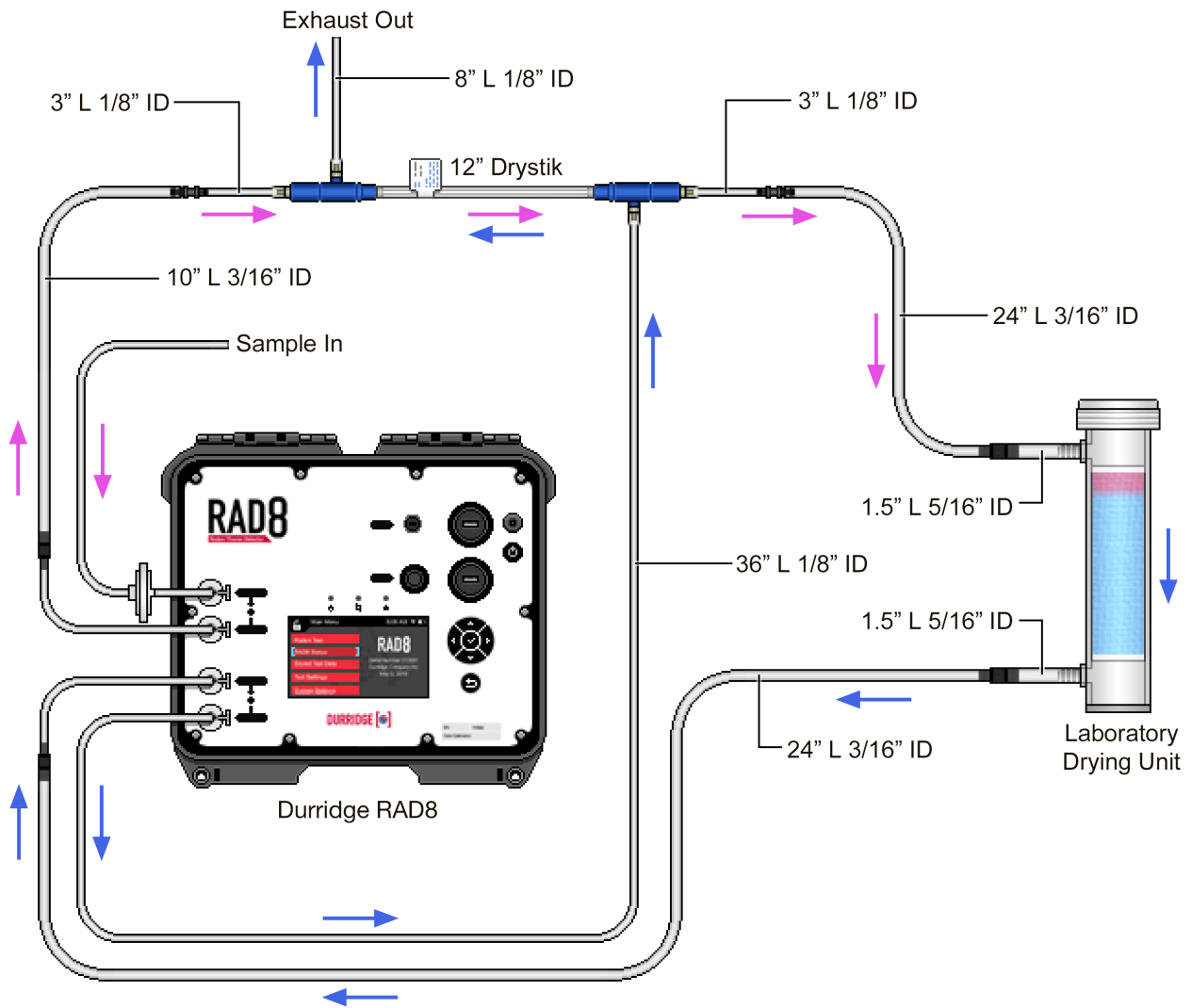


Fig. 2 12-Inch Passive Drystik Connection to RAD8

2.2 Monitoring Radon in Air

For the fastest rate of humidity reduction, and lowest humidity level in the RAD8, a Laboratory Drying Unit with new or regenerated desiccant should be placed between the Drystik and the RAD8's Sample In port. The outlet of the RAD8 is fed to the purge connection of the Drystik to provide a counterflow purge of the sheath around the membrane tubing. The purge outlet (labeled Exhaust Out in the Figure 2) may be left with nothing connected, or can be connected to downstream instruments.

Before starting any measurement with the RAD8 it should first be purged for at least five minutes. This can be done either with the Drystik connected or disconnected. Use the RAD8's Purge function [Start Test → Purge], to remove residual radon from any previous measurement.

When purging is complete, start the RAD8 test using the desired protocol. Using a protocol such as Sniff in which the pump runs continuously will provide the maximum drying power, but will also increase the risk of water condensing in the tubing. For long-term operation, a protocol using 'Standard' pump mode may be sufficient, especially if the Drystik is used in series with a Laboratory Drying Unit.

2.3 Monitoring Thoron in Air

The significant difference between measuring radon and measuring thoron is the half life of thoron (56 seconds). Because this is so short, the delay between the air being sampled at the sampling point and being measured in the instrument is a cause of loss of sample by radioactive decay during sample acquisition. Thus it improves thoron sensitivity to minimize the volume of the sample acquisition path. To that end, the Small Drying Tube should be put in the path to the RAD8 instead of the Laboratory Drying Unit. Additionally, when measuring thoron the RAD8 pump should be always set to run continuously as opposed intermittently. This can be achieved by selecting the RAD8's 'Sniff' Preset Protocol.

If a Cycle Time longer than 5 minutes is desired, a Custom Protocol may be configured. Be sure to set the protocol's Pump Mode to 'On', and enable the Thoron Display option, so that a thoron graph line appears on the RAD8's Chart panel.

3 TROUBLESHOOTING

4.1 Water Enters The Drystik

If water enters the Drystik, the following actions should be taken to ensure that the instrument does not sustain permanent damage.

1. Connect a tube and pump to the output of the Drystik. Start the RAD8 pump [Start Test > Purge] and make sure that a) air is coming out of the Drystik tube and b) there is no liquid coming out. If you see liquid coming out, keep pumping until you see no liquid. To speed up the drying, you can connect a Laboratory Drying Unit containing good desiccant at the start of the air path.
2. Once you are sure that the Drystik will not spit out any liquid, connect the output of the Drystik directly to the RAD8 inlet filter, connect the RAD8 outlet to a Laboratory Drying Unit with good desiccant, and connect the other end of the Laboratory Drying Unit to the purge input on the Drystik. There will be no desiccant in the sample path leading to the RAD8, but the purge flow will be dry.
3. Turn on the RAD8, but do not start any test. Check the RH on the Test Status screen.
4. Start the RAD8 pump [Start Test > Purge]. Check that there is flow out of the Drystik. Continue the pump until the RAD8 RH reading drops down to below 5%.

4.2 Dust Enters The Drystik

It is important to prevent dust from entering the Drystik and becoming lodged in its Nafion tubing. If there is any dust in the air entering the Drystik, a 5-micron dust filter should be included in the air path.

If dust lands inside the Nafion tubing it may affect results by a) raising the RAD8 background due to trace amounts of radium in the dust, b) contaminating the Nafion so that it loses its efficiency, and c) reducing the flow rate by partially blocking the capillary tubing.

In these cases it may be possible to address the problem by removing the Nafion tubing and carefully washing it, but it is more typically necessary for the Drystik to be returned for service so that the Nafion tubing can be replaced by DurrIDGE personnel.

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