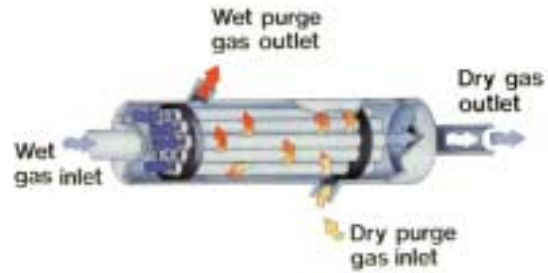


PRINCIPLE OF OPERATION



PD™-Series gas dryers are shell and multi-tube moisture exchangers that transfer water vapor between two countercurrent flowing gas streams as shown in the figure above. The dryers consist of a bundle of Nafion® polymer tubes surrounded by an outer tube.

Dry purge gas flowing over the exterior surface of the Nafion tubing continuously extracts water vapor from the gas stream inside the tubing. The driving force is the difference in water concentration on the opposite sides of the tubing wall. The purge gas then carries the water vapor away.

INSTALLATION SPECIFICATIONS

When installing PD-Series gas dryers, the following rules apply:

- Sample pressure equal to or greater than purge pressure
- Sample gas pressure not to exceed 80 psig
- Purge gas pressure not to exceed 10 psig
- Temperatures must not exceed 120°C for SA, SS, KS or KA models, and 90°C for PP or PS models
- If sample dew point is above ambient temperature, inlet of dryer must be heated (contact factory for details)
- Purge air of -40°C dew point at a flow rate of two to three times sample flow
- Sample and purge air must flow countercurrent to each other

WARNING!

When connecting any fitting to the purge ports of the dryer, be sure not to tighten the threaded fitting more than 5 turns. More turns may cause the fitting to damage the element header just below.

1. STANDARD METHOD

The most efficient way to set up PD-Series dryers is to have sample enter through the 1/4" NPT port and the purge gas enter through the 1/8" NPT port at the opposite end (see Figure 1). Purge gas should be instrument air or other dry gas. If no dry purge air is available, one of the following methods may be used.

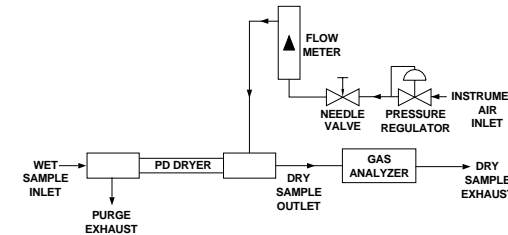


Figure 1 - Typical Setup

2. REFLUX METHOD

The reflux setup, shown in Figure 2, returns dry sample back to the dryer for use as the purge gas after it has gone through the analyzer. Since this method uses all of the dry sample as the purge gas, only the sample flow required for analysis passes through the dryer. This results in high drying efficiency.

The vacuum on the purge gas should be at least 15" of Hg, with a higher vacuum preferable. This vacuum level is necessary to provide the desired 2:1 purge-to-sample flow ratio based on the actual volumetric flow.

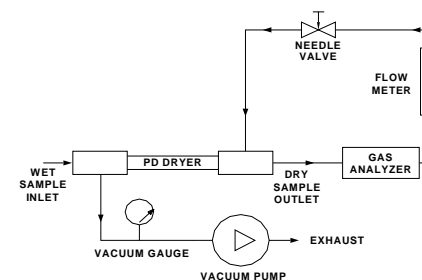


Figure 2 - Reflux Setup

3. SPLIT SAMPLE METHOD

The split sample method, shown in Figure 3, diverts some of the sample from the main stream to be used as the purge gas. More sample passes through the dryer than is required for the analysis, lowering the drying efficiency somewhat.

The following equation can be used to determine the purge flow rate required for the split sample method. Any units may be used as long as they are consistent.

NOTE: Pressure units must be in absolute terms.

$$V_p = \frac{V_s}{(P_s/2P_v) - 1}$$

Where:

- V_p = Purge flowrate (indicated on flowmeter)
- V_s = Sample flowrate (indicated on flowmeter)
- P_s = Sample pressure (in absolute units)
- P_v = Purge pressure (in absolute units)

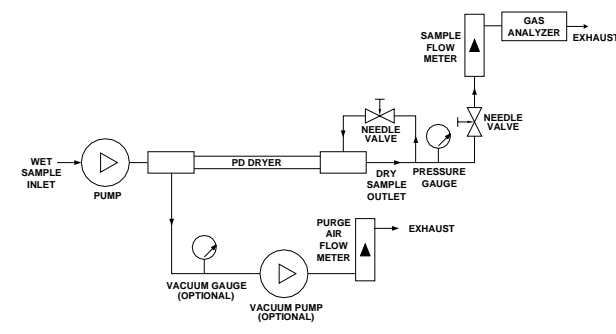


Figure 3 - Split Sample Setup

TO ROTATE FITTINGS

WARNING!

Adjusting the end fittings without following the steps below may cause twisting of the membrane tubing and void the warranty.

Tools Needed:
- Allen wrench 3/32

1. Hold coupling and shell with one hand, and remove front nut with other hand (Refer to Figure 4).
2. Repeat for other side.
3. Loosen two set screws on coupling with Allen wrench.
4. Repeat for other side.
5. Rotate coupling to desired location.
6. Install front nuts onto couplings and tighten fittings as tightly as possible by hand.
7. Tighten set screws on both ends.

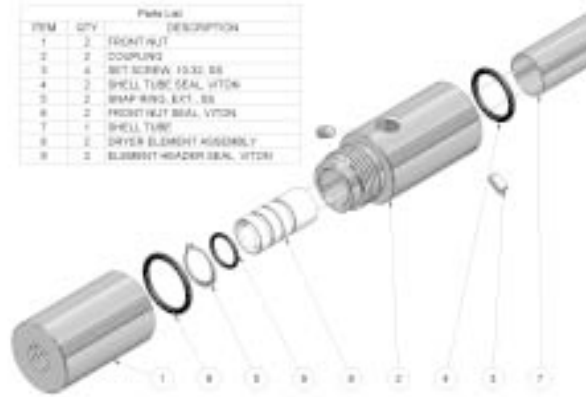


Figure 4

TO DISASSEMBLE DRYER

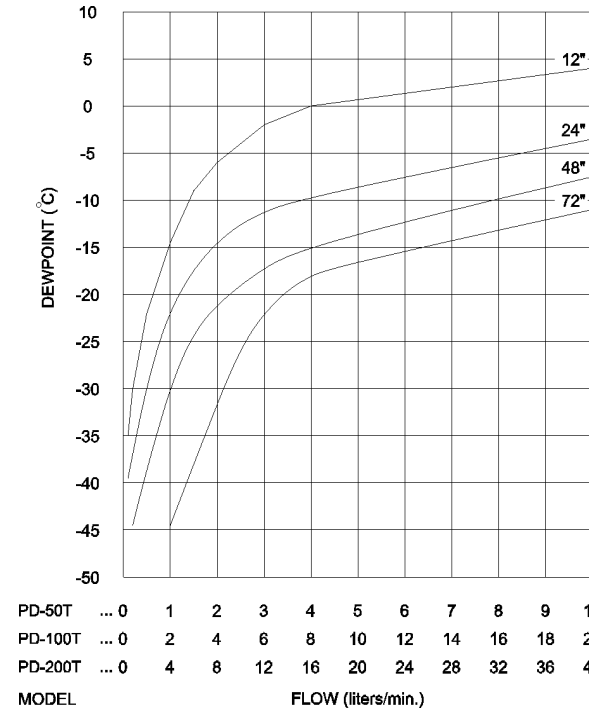
Tools Needed:
-Allen wrench 3/32
-Snap ring plier
-Pair of lightweight gloves

1. Hold coupling and shell with one hand, and remove front nut on each end with the other (Refer to Figure 4).
2. Loosen set screws on both ends of couplings using Allen wrench.
3. Remove snap ring from both sides using snap ring pliers.
4. Put on pair of lightweight gloves (protects membrane tubing from skin oils contaminating surface and reducing drying efficiency).
5. Pull element header out of housing on one side to expose o-ring. **Do not rotate more than 10° in either direction.**
6. Remove inner o-ring.
7. Gently pull element out other end.
8. Reverse procedure to assemble dryer.

Nafion® is a registered trademark of DuPont
PD™ is a trademark of Perma Pure LLC. Bulletin# 204

PERFORMANCE

PD-Series dryer's performance vary according to dryer lengths, flowrates and the number of Nafion tubes.



Performance Curve

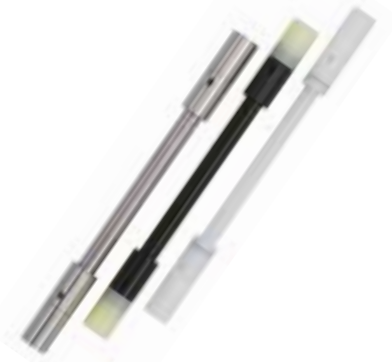
Replacement parts:

Dryer element:
PD-(50,100 or 200)T-(12, 24, 48,72)E
Includes one set of o-rings

Extra o-ring set:
PD-(50,100 or 200)T-3

PD™ -Series Gas Dryer

User Manual



8 Executive Drive
Toms River, N.J. 08755
Phone: 732/244-0010
Fax: 732/244-8140
e-mail: info@permapure.com
Web Site: www.permapure.com