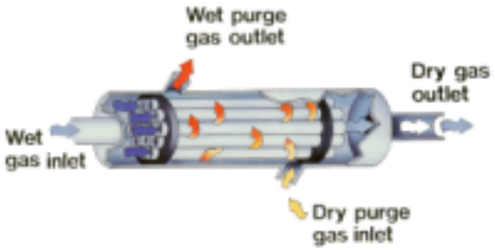
PRINCIPLE OF OPERATION



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.

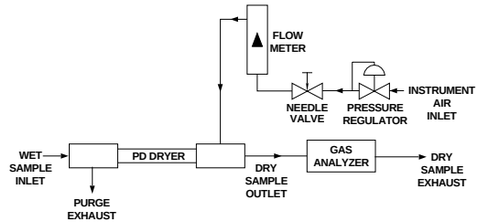


Figure 1 - Typical Setup

2. REFLUX METHOD

The reflux setup, shown in Figure 2, returns dry sample back to the dryer for use as the purge 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.

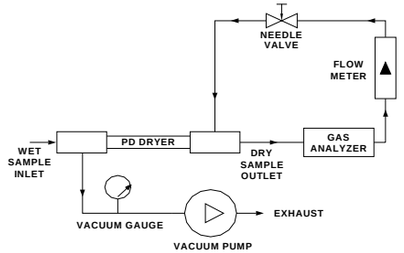


Figure 2 - Reflux Setup

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:
Vp = Purge flowrate (indicated on flowmeter)
Vs = Sample flowrate (indicated on flowmeter)
Ps = Sample pressure (in absolute units)
Pv = Purge pressure (in absolute units)

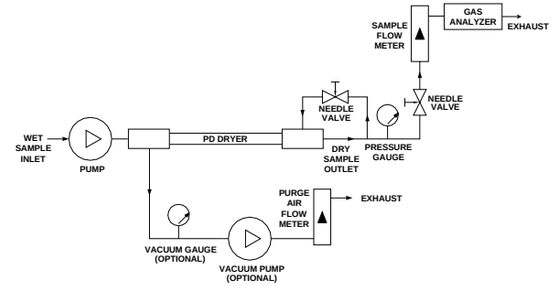


Figure 3 - Split Sample Setup

TO ROTATE FITTINGS

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

Tool Needed:
- Phillips head screwdriver

1. *Turn locking screw 2-3 turns on end of dryer (not necessary to take screw out).*
2. *Position fittings as needed.* ***Do not rotate more than 180 degrees from original position and check to see tubing inside shell is not twisted.***
3. *Align purge port to hole in shell tube (see Figure 4).*
4. *Tighten locking screw.*

Figure 4

TO DISASSEMBLE DRYER

Tools Needed:
- Phillips head screwdriver
- unsharpened pencil with eraser

1. *Loosen locking screws on both ends of dryer.*
2. *Insert eraser end of pencil into one sample port until it rests on tube header face.*
3. *Hold dryer vertically and place other end of pencil down onto a hard, slip resistant surface.*
4. *While supporting shell tube, push lower end fitting down with consistent pressure until it slips off shell tube.* ***Do not attempt to pull fitting from shell tube; doing this is likely to damage dryer element tubing.***
5. *Repeat steps 2-4 for other end.*
6. *Remove one o-ring from tube header (see Figure 5).*
7. *Pull tube element from opposite end of dryer.*

Figure 5

TO ASSEMBLE DRYER

Tool Needed:
- Phillips head screwdriver

1. *Install one thick o-ring onto grooved tube header (Refer to Figure 6).*
2. *Slip opposite tube header into dryer shell.*
3. *Install other thick o-ring onto groove.*
4. *Push one thin o-ring into groove inside coupling (for SS and AL shells slip o-ring on shell across two holes).*
5. *Firmly push coupling over tube header.*
6. *Align purge port with hole in shell tube.*
7. *Tighten locking screws until underside of screw head contacts top of boss.*
8. *Repeat steps 4-7 for opposite end.*

Parts List		
ITEM	QTY	DESCRIPTION
1	2	COUPLING
2	1	SHELL TUBE
3	2	SHELL TUBE SEAL, VITON
4	2	SCREW, 10-24 x 3/8" SS
6	2	DRYER ELEMENT
7	2	ELEMENT HEADER SEAL, VITON

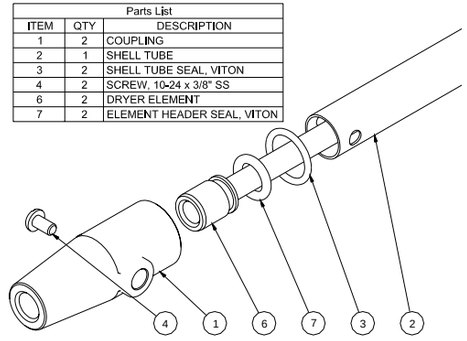
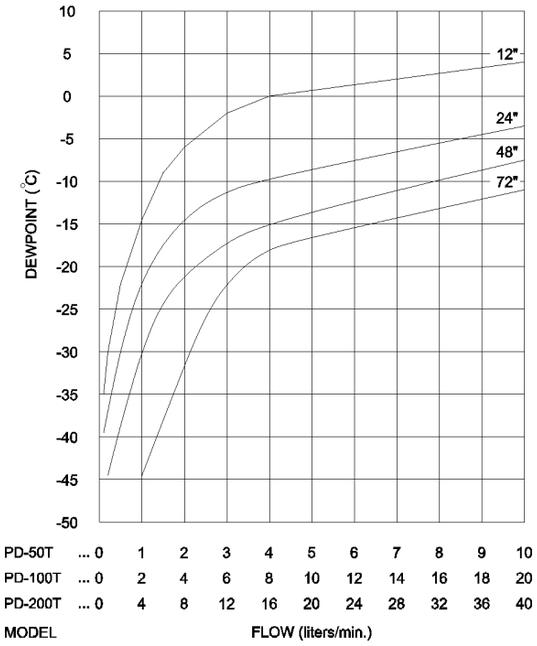


Figure 6

PERFORMANCE

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



Performance Curve

Replacement parts:

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

Extra o-ring set of 4:
PD-50T-3M

Bulletin# 204a

PD™ -Series Gas Dryer

User Manual

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