TO ROTATE FITTINGS

Tools Needed:
- Two wrenches - 5/8 and 7/16
- Tweezers

Refer to Figure 4

1. *Hold tee fitting with appropriate wrench above and loosen union fitting with additional wrench.*
2. *Remove fitting.*
3. *Rotate dryer element 10 degrees each way with tweezers or fingertips.*
4. *With two wrenches, loosen inside nut connecting tee fitting to shell tube.*
5. *Rotate tee fitting to desired location and tighten into place.*
6. *Install union into tee fitting while making sure element is not pushed back out of o-ring seal.* ***Take caution to ensure element does not rotate inside shell.***
7. *Tighten union fitting by hand and then tighten 1/4 turn with wrench.*

TO DISASSEMBLE DRYER

Tools Needed:
- Two wrenches - 5/8 and 7/16
- Pair of lightweight gloves

1. *Repeat steps 1-4 for other end.*
2. *Put on lightweight gloves to protect membrane tubing (skin oils can contaminate surface).*
3. *Gently push one end of element out of o-ring while pulling other end out of tee fitting.*
4. *Gently pull element out of housing from opposite end.*
5. *Reverse for reassembly. Element ends should extend equally from each end of shell housing before installing union fittings.*

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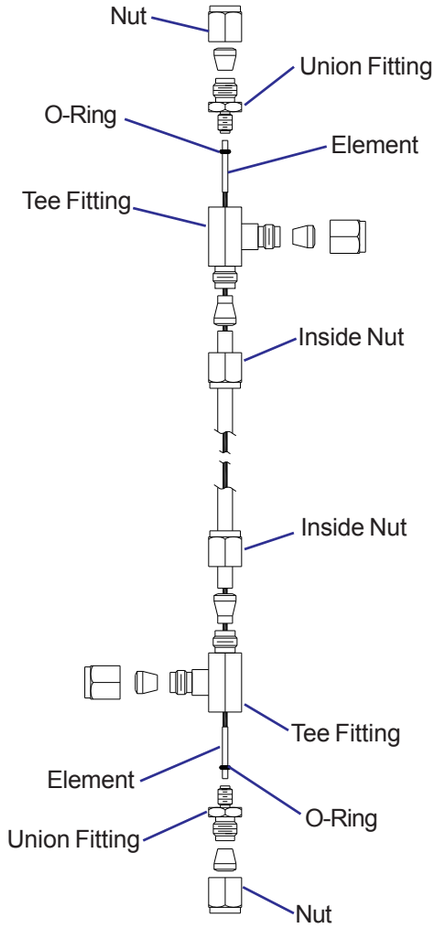


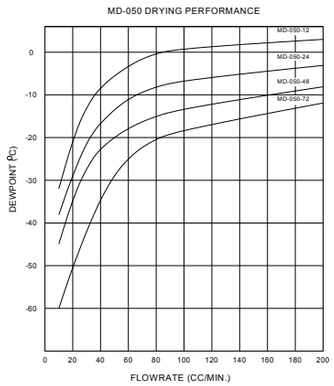
Figure 4

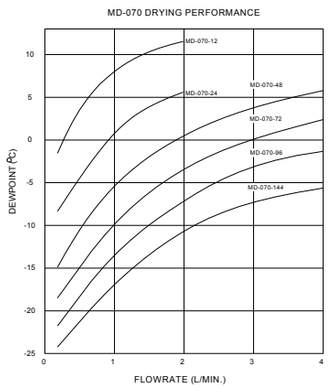
WARNING!

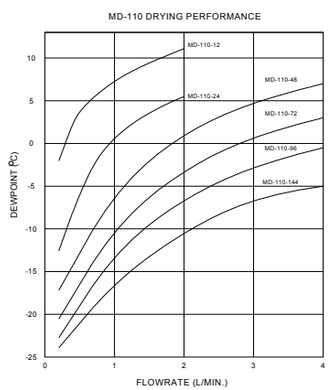
When connecting sample line to dryer, hold union fitting with a wrench before tightening the compression nut. Failure to do so may over-tighten the union connector fitting, twist dryer membrane and damage the dryer.

PERFORMANCE

MD-Series dryer's performance varies according to dryer lengths, flow rates and length of Nafion tubes.







Performance Curves

MD™ -Series Gas Dryer

User Manual

PERMA PURE

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PRINCIPLE OF OPERATION

MD™-Series gas dryers are shell and tube moisture exchangers that transfer water vapor between two countercurrent flowing gas streams. The dryers consist of a Nafion® polymer tube 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 MD-Series gas dryers, the following rules apply:

1. *Sample pressure equal to or greater than purge pressure*
2. *Sample gas pressure not to exceed 80 psig*
3. *Temperatures must not exceed 120°C*
4. *Purge air of -40°C dew point at a flow rate of two to three times sample flow*
5. *Sample and purge air must flow counter-current to each other*
6. *If sample dew point is above ambient temperature, inlet of dryer must be heated (contact factory for details)*

WARNING!

Adjusting end fittings without following the steps on the back page will cause twisting of the membrane tubing and void the warranty.

1. STANDARD METHOD

The most efficient way to set up MD-Series dryers is to have sample enter through the Nafion tube (wet sample inlet) and purge gas flowing countercurrent to the sample (refer to 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.

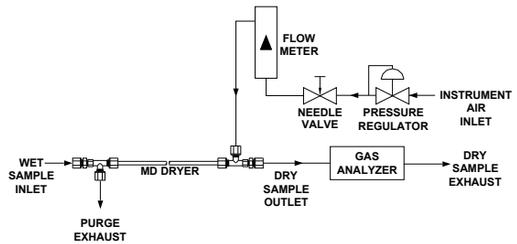

Figure 1 - Typical Setup

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.

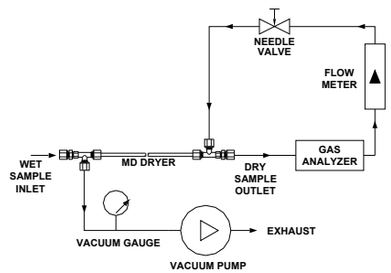

Figure 2 - Reflux Setup

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.

$$V_p = \frac{V_s}{(P_s/1.05P_v) - 1}$$

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)

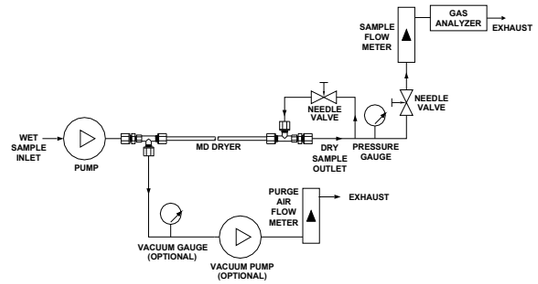

Figure 3 - Split Sample Setup