

## AN-04

# Getting Full Benefit From The Purging Feature Of The ELDV/MDVG GC Diaphragm Valve Rev. 1.2

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The purging feature of the ELDV/MDVG series diaphragm valves makes it unique. The level of performances of this valve series in terms of leak rates and lifetime are by far superior to any valve presently available on the market. This is the best choice. No other diaphragm or rotary GC valve could actually outperform this series.

In order to take full advantage of this valve series, the user must know how the purge works.

The purpose of these application notes is to review the purge concept, understand the factors governing the purge gas, select and review some of the possible purging and actuating configurations.

### 1.0

## VALVE PURGING SYSTEM

The valve has two internal purging circuits. One of the circuits purposes is to protect against inboard and outboard contamination. This circuit consists of two purge grooves engraved into the valve head. The process groove is located between these two purging grooves. Any leak from or into the process groove is caught by these purging grooves and evacuated through the purge vent. This way, the process groove fluid is not contaminated.

The second purge circuit sweeps the space under the diaphragm in order to eliminate air and its contaminants.

The diaphragm is made of various polymers and noticeable permeation may occur through them. Eliminating the air from the back side of the diaphragm eliminates carrier pollution by air contaminants. This purge flow is evacuated through the purge vent.

Figure 1 shows the various purge flow paths through the valve.

The purge may be used in different ways and for different reasons. This is application driven.

### 2.0

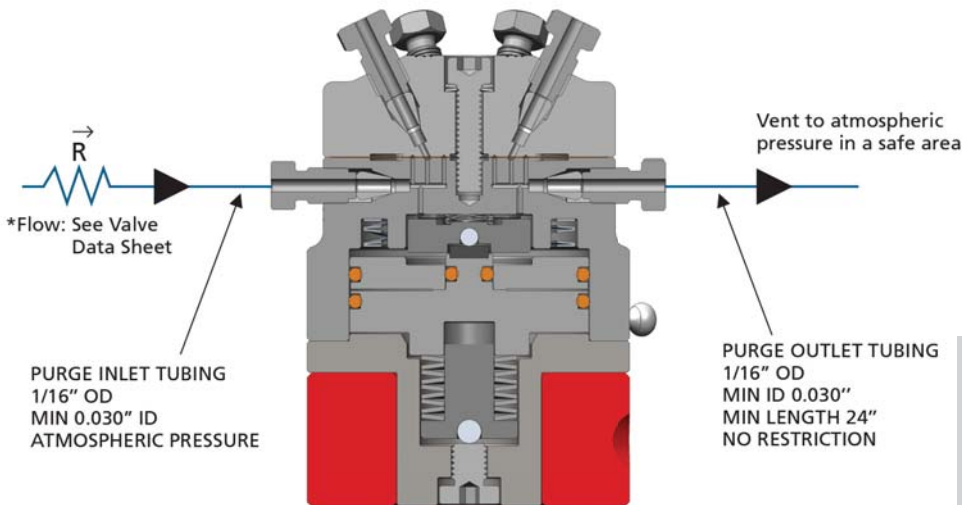
## VARIOUS PURGING AND ACTUATING CONFIGURATIONS

Here are some of the most common uses of the purge:

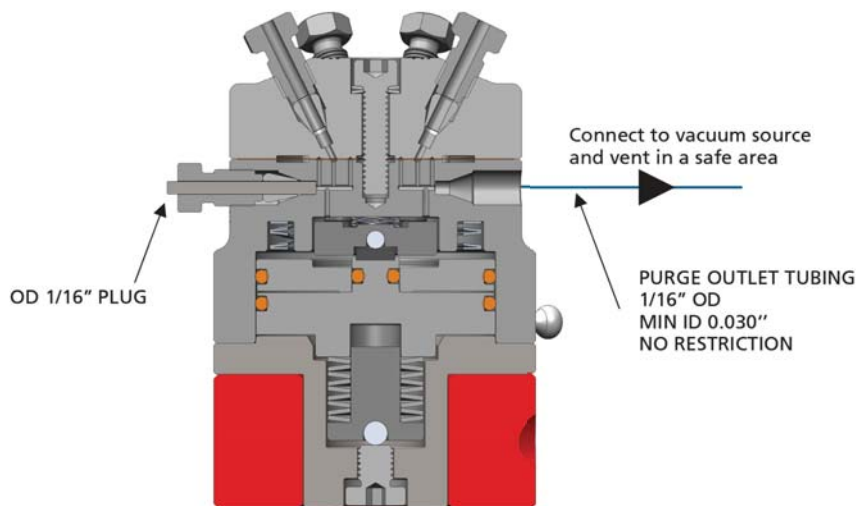
- A** When inert gas is used as carrier gas, the same gas should be used as purge and actuation gas. An example of such applications is when the detector is a high sensitivity helium ionization type (i.e. HID, DID, PID). In such application where conventional diaphragm GC valve is used, the carrier is invariably polluted by air diffusion through the diaphragm. The purge makes sure that the process groove of the valve is isolated by clean carrier gas. This eliminates pollution risks. It is also possible to use dry air or nitrogen to actuate the valve in such applications. Sub PPB permanent gas measurements are easy to realize with this configuration. There is simply no ghost peak or baseline shifts.
- B** When the carrier gas is H<sub>2</sub> or O<sub>2</sub>, the purge could also be H<sub>2</sub> or O<sub>2</sub>. However, it is recommended to actuate the valve with N<sub>2</sub> or other inert gas. This is to eliminate the risk of hazardous situations. The purge gas should be vented in a safe area.
- C** When vacuum operation is required like in GC/MS or when the sample is under vacuum, the purge inlet port is plugged and the valve purge outlet is connected to the vacuum source.

**D** When working with toxic or reactive gases, purge and actuating gas must be an inert gas. Furthermore, the user must make sure that all valve purge vents are evacuated into a safe area. For example, purging with N<sub>2</sub> dry gas when sample is pure silane will prevent a fire if the diaphragm becomes punctured. The user must always make sure that there is no risk of a hazardous situation.

Other purging and actuating configurations are possible. This is again dependent of the target application. In some cases, no purge at all would be acceptable suitable. First of all, the system integrators must be sure that the selected configuration, is safe. Secondly of all, users must make sure that the selected configuration will effectively work as required by application.



**Figure 1:**  
Typical purge tubing setup for atmospheric purge flow. Used when sample is at atmospheric or higher pressure.



**Figure 2:**  
Vacuum purge tubing setup, used when sample or carrier is at sub-atmospheric pressure.

**LEGEND :**  
R: FLOW RESTRICTOR

Another benefit of the purge system is the possibility to monitor the quality of the purge gas coming from the purge vent and compare it with the carrier generated signal. If there is too much of a difference between these two signals, it means that the valve system is leaking. This feature gives an early warning of valve wearing. This also prevents unscheduled system shutdowns. Figure 3 shows how to build such a configuration.

Two 3-way DV3 valves are used to sample the purge outlet of the valve. The idea is to periodically check the purge gas quality. A signal threshold value is fixed to establish the warning point. The verification could be done once a day, a week or a month. This is application dependent. The purge gas sampling time should be just enough to get detector signal stabilization. The system acquires the signal and compares it with the threshold value. In most GC applications, column flow interruption when sampling purge gas, as shown in Figure 3-B, is not a problem. However, by adding another DV3, it's possible to sample the purge gas without affecting GC columns flow.

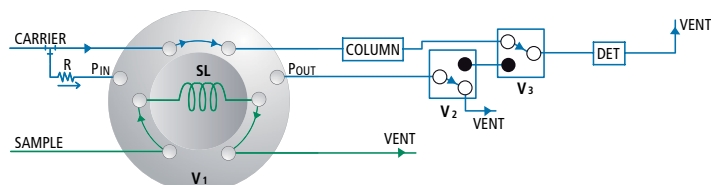


Figure 3-A: Self-Diagnostic configuration; Analyze Mode

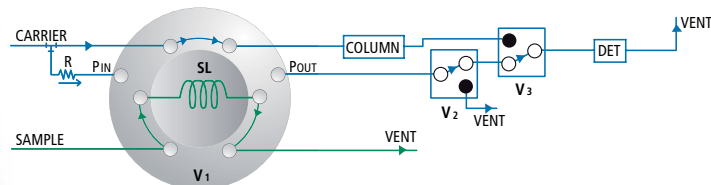


Figure 3-B: Self-Diagnostic configuration; Diagnostic Mode

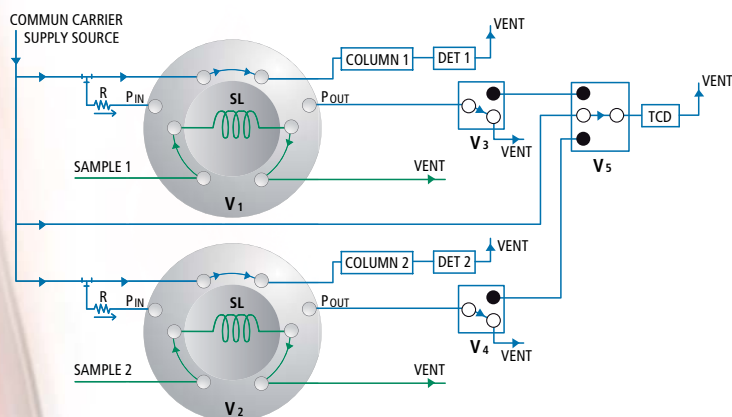


Figure 4: Multiple valve Self-Diagnostic configuration with an independent TCD

The DV3 and DVS valves will not interfere with the chromatogram signal, since they act like simple 1/16" unions: no dead volume effects, no pollution.

Another possible configuration, is to monitor the purge vent with an independent TCD detector. There are several suppliers on the market of inexpensive inline TCD detectors. Sampling the TCD signal at the proper time (once again, it is application dependent) will give the status of the valve. Several valves could be monitored by simply adding an AFP® DVS valve before the TCD. Figure 4 shows such configurations. A stream channel is reserved to sample pure carrier gas, (or the source of the purge gas) to use as reference signal before sampling various valve purge vents.

The purging feature adds some "intelligence" to the valve system. See DV3 and DVS product literature for more information on these products.

### LEGEND :

- R: Capillary Flow Restriction
- PIN: Purge Inlet Port
- POUT: Purge Outlet Port
- V1: ELDV/MDVG GC Diaphragm Valve
- V2, 3: AFP DV3, 3-way Tight Shut-Off Diaphragm Valve

### LEGEND :

- R: Capillary Flow Restriction
- PIN: Purge Inlet Port
- POUT: Purge Outlet Port
- V1, 2: ELDV/MDVG GC Diaphragm Valve
- V3, 4: AFP DV3, 3-way Tight Shut-Off Diaphragm Valve
- V5: AFP DVS, 4-way Tight Shut-Off Diaphragm Valve